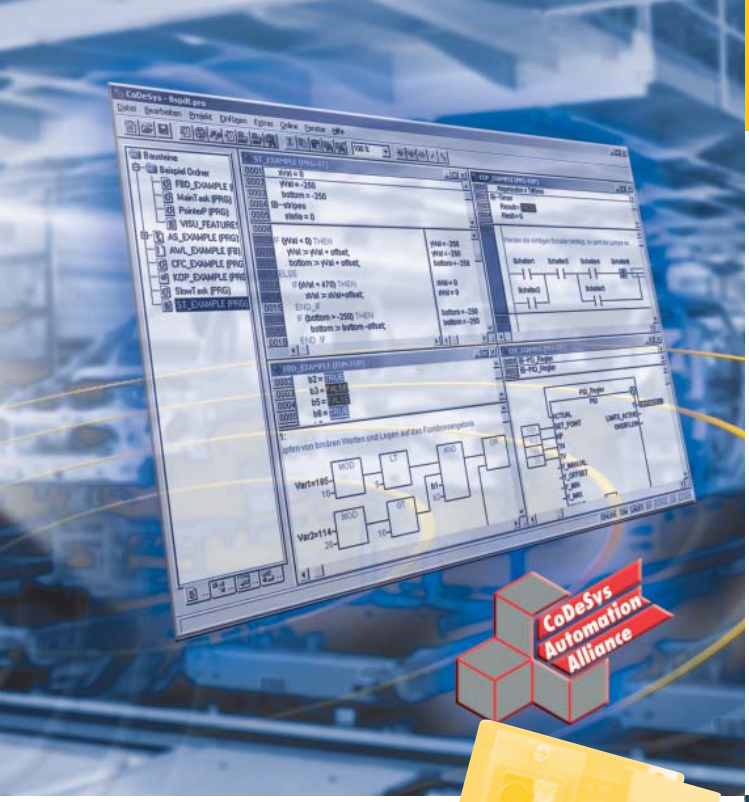
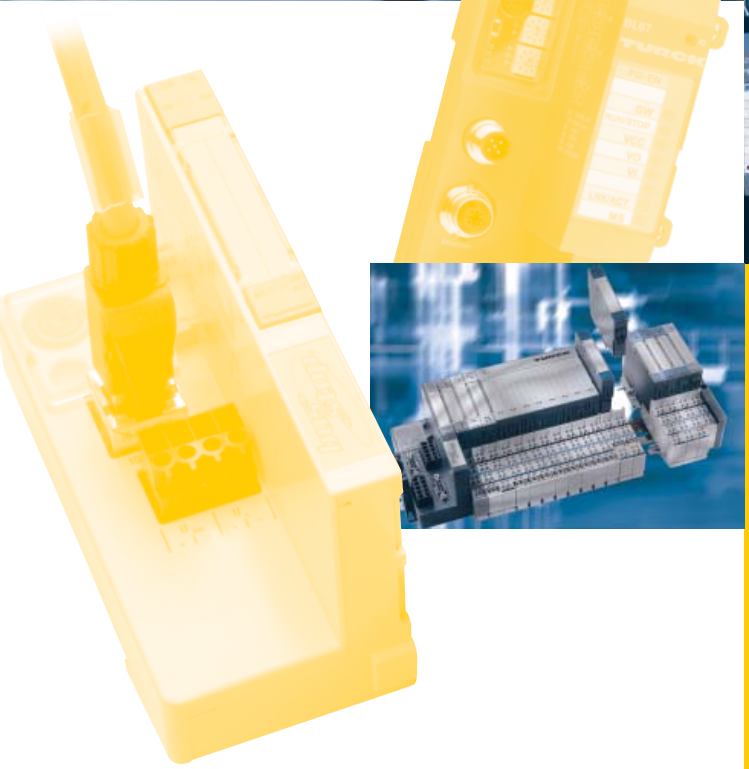
TURCK

Industrial Automation

BL67-

USER MANUAL for BL67-PG-EN





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Subject to alterations without notice.

Before starting the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighboring units that are live.
- Follow the engineering instructions (AWA) of the device concerned.
- Only suitably qualified personnel in accordance with EN 50 110-1/-2 (VDE 0 105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalization. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60 364-4-41 (VDE 0 100 Part 410) or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have

been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.

- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross sections, fuses, PE).
- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60 364 and HD 384 and national work safety regulations).
- All shrouds and doors must be kept closed during operation.

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Documentation Concept

This manual contains information about the programmable BL67 MODBUS-TCP gateway BL67-PG-EN.

The following chapters contain a short BL67 system description, a description of the field bus system Ethernet, exact information about function and structure of the BL67 Ethernet gateways as well as all bus specific information concerning the connection to automation devices, the maximum system extension etc.

The bus-independent I/O-modules for BL67 as well as all further fieldbus-independent chapters like mounting, labelling etc. are described in a separate manual.

- BL67 I/O-modules
  (TURCK-Documentation-No.: German D300572/
  English D300529)

Furthermore, the manual mentioned above contains a short description of the project planning and diagnostics software for TURCK I/O-systems, the engineering software I/O-ASSISTANT.

General Information

Attention

Please read this section carefully. Safety aspects cannot be left to chance when dealing with electrical equipment.

This manual contains all necessary information about the prescibed use of the programmable TURCK gateway BL67-PG-EN.
It has been specially conceived for personnel with the necessary qualifications.

Prescribed Use

Warning

The devices described in this manual must be used only in applications prescribed in this manual or in the respective technical descriptions, and only with certified components and devices from third party manufacturers.

Appropriate transport, storage, deployment and mounting as well as careful operating and thorough maintenance guarantee the trouble-free and safe operation of these devices.

Notes Concerning Planning /Installation of this Product

Warning

All respective safety measures and accident protection guidelines must be considered carefully and without exception.

Description of Symbols Used

Warning

This sign can be found next to all notes that indicate a source of hazards. This can refer to danger to personnel or damage to the system (hardware and software) and to the facility.

This sign means for the operator: work with extreme caution.

Attention

This sign can be found next to all notes that indicate a potential hazard.

This can refer to possible danger to personnel and damages to the system (hardware and software) and to the facility.

Note

This sign can be found next to all general notes that supply important information about one or more operating steps. These specific notes are intended to make operation easier and avoid unnecessary work due to incorrect operation.

1 BL67 Philosophy

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The Basic Concept

BL67 is a modular IP67 I/O-system for use in industrial automation. It connects the sensors and actuators in the field to the higher-level master.

BL67 offers modules for practically all applications:

- Digital input and output modules
- Analog input and output modules
- Technology modules (RS232 interface,...)

A complete BL67 station counts as **one** station on the bus and therefore occupies **one** fieldbus address in any given fieldbus structure. A BL67 station consists of a gateway, power distribution modules and I/O-modules.

The connection to the relevant fieldbus is made via the bus-specific gateway, which is responsible for the communication between the BL67 station and the other fieldbus stations.

The communication within the BL67 station between the gateway and the individual BL67 modules is realized via an internal module bus.

Note

The gateway is the only fieldbus-dependent module on a BL67 station. All other BL67 modules are not dependent on the fieldbus used.

Flexibility

A BL67 station can contain modules in any combination, which means it is possible to adapt the system to practically all applications in automated industries.

Convenient Handling

All BL67 modules, with the exception of the gateway, consist of a base module and an electronic module.

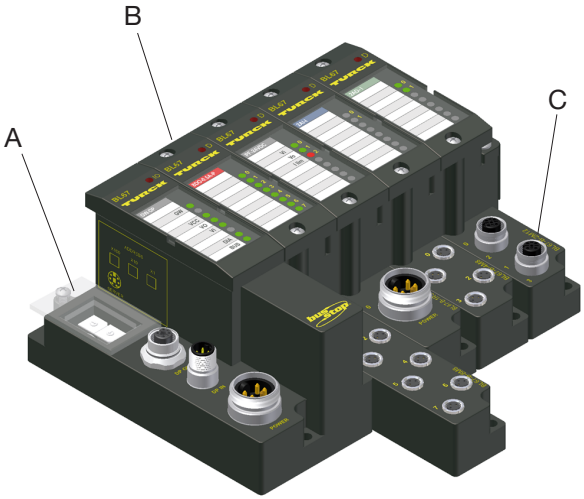
The gateway and the base modules are either snapped onto a mounting rail or are directly mounted onto the machine frame. The electronic modules are plugged onto the appropriate base modules.

After disconnection of the load, the electronic modules can be plugged or pulled when the station is being commissioned or for maintenance purposes, without having to disconnect the field wiring from the base modules.

BL67 Components

Figure 1:
BL67 station

A *gateway*
B *electronic module*
C *base module*



Gateways

The gateway connects the fieldbus to the I/O-modules. It is responsible for handling the entire process data and generates diagnostic information for the higher-level master and the software tool I/O-ASSISTANT.

Figure 2:
BL67 gateway

Electronic Modules

Electronic modules contain the functions of the BL67 modules (Power Feeding modules, digital and analog input/output modules, technology modules).

Electronic modules are plugged onto the base modules and are not directly connected to the wiring. They can be plugged or pulled when the station is being commissioned or for maintenance purposes, without having to disconnect the field wiring from the base modules.

Figure 3: electronic module

Power Feeding Modules

Power Feeding modules distribute the required 24 V DC field voltage to the I/O-modules. They are necessary for building groups of modules with different potentials within a BL67 station, or if the rated supply voltage for the outputs cannot be guaranteed.

Power Feeding modules are potentially isolated from the gateway, the adjoining power supply module and the I/O-modules to the left side.

Note

For detailed information about the individual BL67 I/O components, please refer to the chapters 2 to 8 of the manual "BL67- I/O-modules" (TURCK Documentation-No.: German D300572; English: D300529).
The "Appendix" to the manual mentioned above contains (amongst others) a list of all BL67 components and the assignment of electronic modules to base modules.

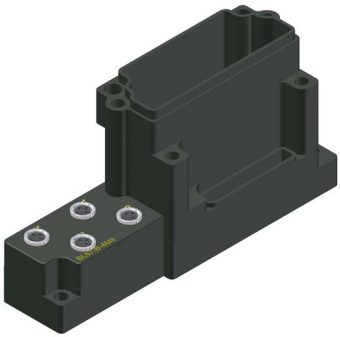
Base Modules

The field wiring is connected to the base modules.

These are available in the following connection variations:

- 1 x M12, 2 x M12, 2 x M12-P, 4 x M12, 4 x M12-P
- 4 x M8, 8 x M8
- 1 x M12-8
- 1 × M23, 1 x M23-19
- 1 x 7/8" (for Power Feeding Module)

Figure 4: example of a base module

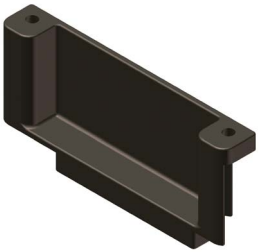


End Plate

An end plate on the right-hand side physically completes the BL67 station.

It protects the module bus connections of the last base module in a station and guarantees the protection class IP67.

Figure 5:
end plate



2 Ethernet

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System Description

Originally developed by DEC, Intel and Xerox (as DIX standard) for data transmission between office equipment, Ethernet stands for the IEEE 802.3 CSMA/CD specification published in 1985.

The rapid increase of application and the worldwide use of this technology enables problem-free and above all cost-effective connection to existing networks.

Ethernet MAC-ID

The Ethernet MAC-ID is a 6-byte-value which serves to definitely identify an Ethernet device. The MAC-ID is determined for each device by the IEEE (Institute of Electrical and Electronics Engineers, New York).

The first 3 bytes of the MAC-ID contain a manufacturer identifier (TURCK: 00:07:46:xx:xx:xx). The last 3 bytes can be chosen freely by the manufacturer for each device and contain a definite serial number.

A label on the TURCK modules shows the respective MAC-ID.

In addition to that, the MAC-ID can be read out using the software tool "I/O-ASSISTANT".

IP address

Each Ethernet-host receives its own IP address. In addition to that the node knows its netmask and the IP address of the default gateway.

The IP address is a 4-byte-value which contains the address of the network to which the node is connected as well as the host address in the network.

The IP address of the gateway BL67-PG-EN is predefined as follows:

IP address: 192.168.1.254

netmask: 255.255.255.0

gateway: 192.168.1.1

The netmask shows which part of the IP address defines the network as well as the network class and which part of the IP address defines the single node in the network.

In the example mentioned above, the first 3 bytes of the IP address define the network. They contain the subnet-ID 192.168.1.
The last byte of the IP address defines the node's address within the network.

Note

In order to build up the communication between a PC and an Ethernet-module, both have to be nodes of the same network.

If necessary, the nodes' network addresses have to be adapted one to another. Please read Chapter 8, „Changing the IP address of a PC/ network interface card", page 8-3.

Network Classes

The available networks are divided into the different network classes A, B, and C.

Figure 6: Network classes

Class	Network addresses	Bytes for net address	Bytes for host address	No. of the possible networks/ hosts
A	1.xxx.xxx.xxx-126.xxx.xxx.xxx	1	3	126/ 2^{24}
B	128.0.xxx.xxx - 191.255.xxx.xxx	2	2	2^{14}/ 2^{16}
C	192.0.0.xxx - 223.255.255.xxx	3	1	2^{21}/ 256

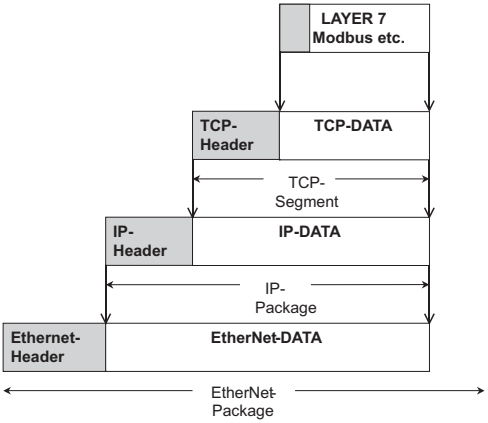
According to their predefined address 192.168.1.xxx the BL67 gateways are thus nodes of a Class C network.

Data transfer

The data are transferred from a transmitter to a receiver via the Ethernet. This data transfer uses no acknowledgement of reception, which means data telegrams can get lost. Data transfer via Ethernet without any protocol implementation can thus not be absolutely safe.

In order to assure a safe transmission of data, frame-protocols like TCP/IP are used.

Figure 7: Telegram structure



IP (Internet Protocol)

The Internet Protocol is a connection-free transport protocol. The protocol does not use acknowledgement messages, telegrams can get lost. It is thus not suitable for safe data transfer. The main functions of the internet protocol are the addressing of hosts and the fragmentation of data packages.

TCP (Transmission Control Protocol)

The Transmission Control Protocol (TCP) is a connection-oriented transport protocol and is based on the Internet Protocol. A safe and error-free data transport can be guaranteed by means of certain error diagnostic mechanisms as for example acknowledgement and time monitoring of telegrams.

MODBUS-TCP

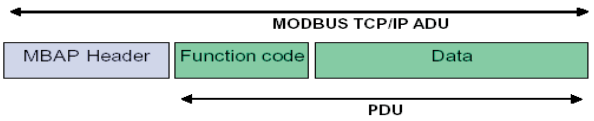
In Ethernet TCP/IP networks, MODBUS-TCP uses the Transport Control Protocol (TCP) for the transmission of the Modbus application protocol.

All parameters and data are embedded in the user data of the TCP-telegram using the encapsulation protocol: the client generates a special header (MBAP = Modbus Application Header), which enables the server to clearly interpret the received Modbus-parameters and -commands.

The Modbus protocol is thus part of the TCP/IP-protocol.

The communication via Modbus is realized by means of function codes embedded in the data telegram.

Figure 8: telegram structure MODBUS-TCP



The function codes contain, amongst others, commands for reading input data or writing output data. Please read Chapter 4, „Implemented Modbus Functions”, page 4-17 for further information about the function codes implemented in the BL67 gateway.

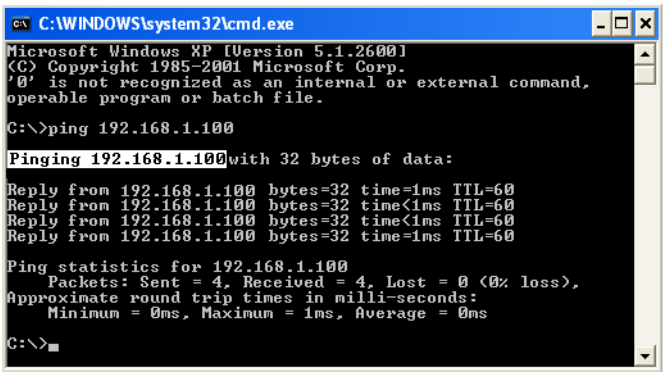
Checking the communication via "ping-signals"

You can check the communication between nodes in a network using ping-signals in the DOS-prompt of your PC.

For that purpose, please enter the command "ping" and the IP address of the network node to be checked.

If the node answers the ping-signal, it is ready for communication and takes part in the data transfer.

Figure 9: ping-signal


C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
'0' is not recognized as an internal or external command,
operable program or batch file.
C:\>ping 192.168.1.100
Pinging 192.168.1.100with 32 bytes of data:
Reply from 192.168.1.100 bytes=32 time=1ms TTL=60
Reply from 192.168.1.100 bytes=32 time<1ms TTL=60
Reply from 192.168.1.100 bytes=32 time<1ms TTL=60
Reply from 192.168.1.100 bytes=32 time=1ms TTL=60
Ping statistics for 192.168.1.100
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>

ARP (Address Resolution Protocol)

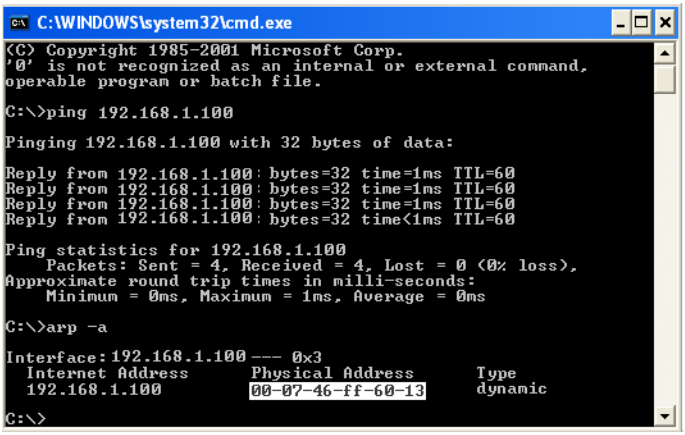
In each TCP/IP-capable computer, ARP serves to clearly assign the worldwide unique hardware addresses (MAC-IDs) to the single IP addresses of the network nodes via internal tables.

Using ARP in the DOS-prompt, every node in a network can be clearly identified via its MAC-ID.

- Write a ping command for the respective station/ IP address: (example: "x:\\ping 192.168.1.100").

- Via the command "x:\\arp -a" the MAC-ID (00-07-46-ff-60-13) for this IP address is determined. This MAC-ID clearly identifies the network node.

Figure 10: Determination of the MAC-ID of a BL67 module via ARP



Transmission Media

For a communication via Ethernet, different transmission media can be used (see Chapter 7, page 7-4).

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General

This chapter contains the general technical description of the programmable BL67 gateway for Modbus TCP.

Function

The programmable BL67 gateways can be used as an autonomous PLC or as a de-central PLC in a network interconnection for fast signal processing

Hinweis

The programmable BL67 gateway BL67-PG-EN is designed as a Single Task System.

The gateway handles the entire process data traffic between the I/O-level and the PLC runtime system.

Programming

The gateways BL67-PG-××× are programmable according to IEC61131-3 using the software tool CoDeSys V2.3 from 3S - Smart Software Solutions GmbH.

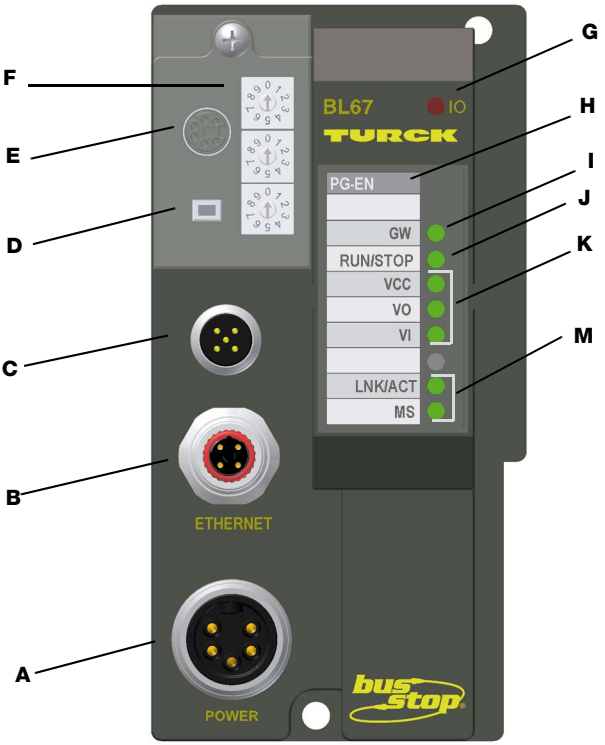
For programming the gateway, the following programming languages according the standards can be used:

LD	= Ladder
FDB	= Function Block Diagram
IL	= Instruction List
ST	= Structured Text
SFC	= Sequential Function Chart

Technical Data

Figure 11:
BL67-PG-EN

A *power supply*
B *Ethernet*
C *n.c.*
D *SET-button*
E *service-interface*
F *rotary coding switches*
G *module bus LED*
H *designation*
I *status LED*
J *RUN/STOP LED*
K *LEDs for supply voltage monitoring*
L *Ethernet LEDs*



Structure of PLC runtime system

The BL67-PG-EN has the following structure:

Figure 12: Structure of PLC runtime system

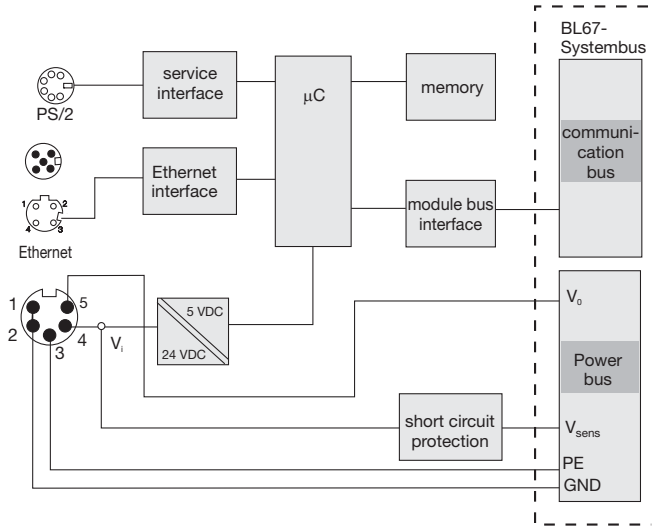


Table 1: Technical data Ethernet gateway

Supply voltage		
System supply V_I (U_B)	24 VDC	used to generate the galvanically isolated module bus supply
permissible range	18 to 30 VDC	
Field supply V_O (U_L)	24 VDC	
permissible range	18 to 30 VDC	
I_{sys}	600 mA	current consumption CPU + module bus at maximum system extension

I_{MB}	max. 1,3 A	maximum output current of module bus supply
I_{VI}	max. 4 A	short-circuit and overload protection of the sensor supply from gateway or power feeding module
Isolation voltages		
U_{RS} (Ethernet/ service interface)	500 V AC	
U_{EN} (Ethernet/ module bus)	500 V DC	
U_{sys} (V_O/V_I to U_{sys})	1000 V DC	

SPS-data	
Programming	
– Software – Released for	CoDeSys V 2.3 V 2.3.5.8
– Programming languages	IEC 61131-3 (IL, LD, FDB, SFC, ST)
– Application tasks	1
– No. of POUs (Program Organization Unit)	1024
– Programming interfaces	RS232-interface, Ethernet
Processor	RISC, 32 bit
– Cycle time	< 1 ms for 1000 IL-commands (without I/O-cycle)

– Real time clock	yes
Memory	
– Program memory	512 KByte
– Data memory	512 KByte
– Input data	4 KByte (physical input data and network variables)
– Output data	4 KByte (physical output data and network variables)
– Non-volatile memory	16 KByte
Ambient conditions	
Ambient temperature	
– $t_{Ambient}$	0 to +55 °C /32 to 131 °F
– t_{Store}	- 25 to +85 °C / - 13 to 185 °F
Relative humidity	5 up to 95 % (inside), level RH-2, no condensation (at 45 °C storage temperature)
Climatic tests	according to IEC 61131-2
Corrosive gas	according to IEC 60068-2-42/43
– SO_2	10 ppm (rel. humidity < 75 %, no condensation)
– H_2S	1.0 ppm (rel. humidity < 75 %, no condensation)
Resistance to vibration	according to EN 61131
– 10 to 57 Hz,constant amplitude 0.075 mm, 1 g	yes
– 57 to 150 Hz, constant acceleration 1 g	yes
– Vibration mode	frequency cycles with a change rate of 1 octave/min

– Vibration duration	20 frequency cycles per coordinate axis
Application conditions	according to EN 61131
Shock resistant	according to IEC 68-2-27, 18 shocks, semi-sinusoidal 15 g threshold/11 ms, each in ± direction per space coordinate
Repetitive shock resistance	according to IEC 68-2-29, 1000 shocks, semi-sinusoidal 25 g threshold/6 ms, each in ± direction per space coordinate
Drop and topple	according to IEC 68-2-31 and free fall according to IEC 68-2-32
– Drop height (weight < 10 kg)	1 m
– Drop height (weight 10 to 40 kg)	0.5 m
– Test cycles	7
Protection class	IP67 according to IEC 60529
Electromagnetic capability (EMC)	according to EN 61131-2/ EN 50082-2 (Industrial)
Static electricity according to EN 61000-4-2	
Air discharge (direct)	8 kV
Relay discharge (indirect)	4 kV
Electromagnetic HF fields	according to IEC 61131-2
Fast transients (Burst)	according to IEC 61131-2
Conducted interferences induced by HF fields	according to IEC 61000-4-6 10 V Criteria A

A *I/O-line-length ≤ 30 m*

High energy transients (Surge) **A** voltage supply	according to IEC 61000-4-5 0,5 kV CM, 12 Ω/ 9 µF 0,5 kV DM, 2 Ω/ 18 µF Criteria B
Reliability	
Operational life MTBF	min. 120000 h
Electronics modules pull/ plug cycles	20
Housing material	PC-V0 (Lexan)
Dimensions	
Width x length x height (mm/inch)	64,5 x 145,0 x 77,5 / 2,54 x 5,71 x 3,05

Warning

This device can cause radio disturbances in residential areas and in small industrial areas (residential, business and trading). In this case, the operator can be required to take appropriate measures to suppress the disturbance at his own cost.

Connection possibilities

Field bus connection

The connection of the BL67 Ethernet gateways to the Ethernet network is realized via the 4-pole M12 female connector “Ethernet“.

According to PNO- and ODVA-standards, the M12 female connector is designed as a 4-pole and D-coded connector.

Figure 13: M12-female connector

Table 2: Pin assignment

Pin-No.		
1	TD+	Transmission Data +
2	RD+	Receive Data +
3	TD-	Transmission Data -
4	RD-	Receive Data -

Power Supply via 7/8" connector

The power supply is realized via a 7/8" male connector on the gateway.

Abbildung 14: power supply via 7/8" male connector

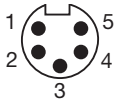


Table 3: Pin assignment of the 7/8" power supply connector

Pin-No.	Color	7/8"	Description
1	black	GND	
2	blue	GND	
3	green/ yellow	PE	Protective earth
4	brown	V_I (U_B)	Feed-in of nominal voltage for input modules (sensor supply); also used for the generation of the system supply voltage
5	white	V_O (U_L)	Feed-in of nominal voltage for output modules (can be switched off separately)

Connection PS2 female connector

The PS/2 female connector is used for the gateway's connection to the I/O-ASSISTANT (project planning and diagnostic software).

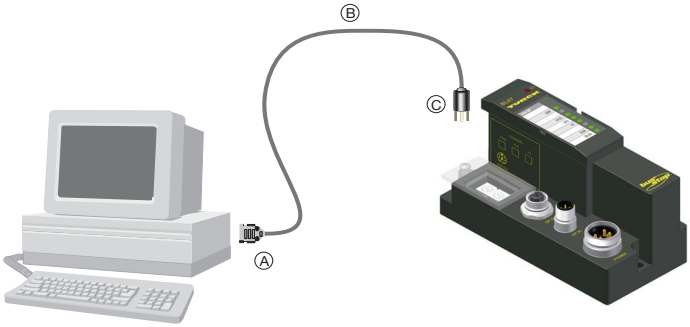
The interface is conceived as a 6-pole mini DIN connector.

In order to connect the gateway to the PC, two types of cables can be used:

- special I/O-ASSISTANT-connection cable from TURCK (IOASSISTANT-ADAPTERKABEL-BL20/BL67; Ident-no.: 6827133)
- Commercially available PS/2 cable with adapter cable SUB-D/ PS/2

Connection with I/O-ASSISTANT-Connection Cable

Figure 15: BL67-gateway connected to PC via special cable



The I/O-ASSISTANT-cables have a PS/2 male connector (connection for female connector on gateway) and a SUB-D female connector (connection for male connector on PC).

Figure 16: PS/2 male connector on the connection cable to the gateway (top view)

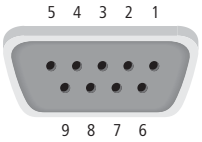


Figure 17: 9-pole SUB-D female connector on the cable for connecting to PC (top view)

Connection Using Commercially Available Cables

A further possibility to connect PC and BL67 gateway is to use a commercially available connection and adapter cable.

The connection shown in the following figure (PS2-male/ PS2-male) is a 6-wire 1:1 connection.

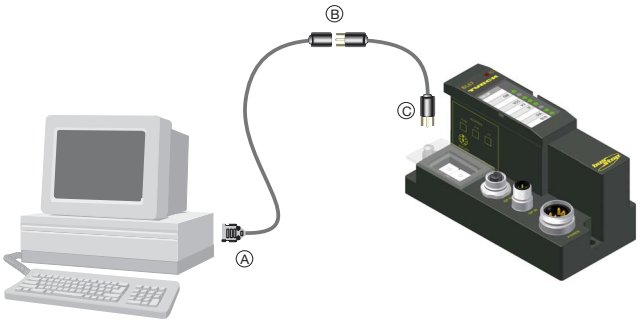


Figure 18: Connection between PC and BL67 gateway via commercially available cable

A *SUB-D- female*
B *PS/2-female <–> PS/2-male*
C *PS/2-male*

The following two cables are necessary:

- 1 x PS/2 cable (PS/2 male connector/PS/2 male connector) (commercially available keyboard extension cable)
- 1 x adapter cable (PS/2 female connector/SUB-D female connector) (commercially available extension cable for a PC mouse)

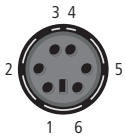
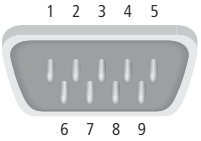


Figure 19: PS/2 female connector on the gateway (top view)

Figure 20: 9-pole SUB-D male connector on PC (top view)



Pin assignment

The table below shows the pin assignment when using a PS/2 cable and adapter:

Table 4: Pin assignment when using PS/2 cable and adapter

A *not supported by all adapter cables.*

PS/2			**9-pole serial interface on PC**	
Pin-No.	Standard PS/2 male connector	BL67 gateway: PS/2 female connector	Pin-No.	Male connector
1	CLK	+5 V (from gateway)	4, 6 **A**	DTR, DSR
2	GND	GND	5	GND
3	DATA	not connected	–	–
4	n.c. (DATA2)	TxD	2	RxD
5	+5 V	/CtrlMode	7	RTS
6	n.c. (CLK2)	RxD	3	TxD

Address Setting

The addressing of BL67-PG-EN can be realized via different modes:

- rotary mode (manual addressing via rotary coding-switches)
- PGM mode (manual addressing via software)
- BootP mode, DHCP mode (automatic addressing via BootP/ DHCP-server at the boot-up of the gateway).

The setting of the address modes is done via the 3 rotary coding-switches at the gateway.

Note

It is not necessary to address the station's internal module bus.

Attention

The cover of the decimal rotary coding-switches must be closed by tightening the screw after use.

The seal in the cover must not be damaged or slipped.

The protection class IP67 can only be guaranteed when the cover is closed correctly.

LED-behavior

During it's start-up, the module waits for the address setting via the BootP-server. This is indicated by the red flashing "MS" LED. The LED begins to flash green, as soon as the address setting via the server is completed. The station is ready for communication.

Default setting of the gateway

The gateway's "out of the box"-settings are the following:

IP address	192.168.1.254
subnet mask	255.255.255.000
default gateway	192.168.1.1

Note

The gateway can be reset to these default settings by the user at any time.
To reset the gateway, please set the three coding-switches at the gateway to "000" followed by a power-on reset.

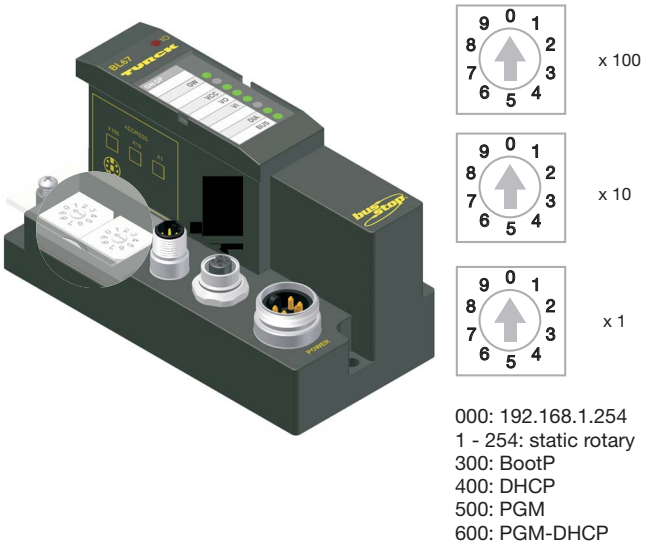


Figure 21: Decimal rotary coding-switches for the address setting

Attention

After every change of the address-mode, a voltage reset must be carried out.

Address setting via the rotary-mode

When using the rotary-mode, the last byte of the gateway's IP address can be set via the rotary coding-switches at the gateway.

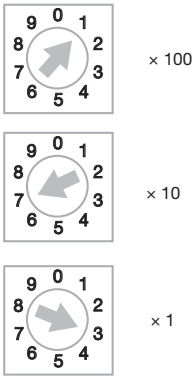
Note

All other network settings are stored in the module's non-volatile EEPROM and can not be changed in the rotary-mode.

Addresses in the range from 0 to 254 can be allocated. The addresses 0 and 255 are reserved for broadcast messages in the subnet.

The following example shows the setting of the address **173**.

Figure 22: Address setting



Attention

The settings carried out in the rotary-mode are not stored in the module's EEPROM. Thus, they will get lost in case of a subsequent address-assignment via a BootP/ DHCP or PGM.

Attention

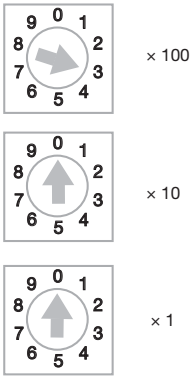
After changing the position of the rotary coding-switches, a voltage reset must be carried out to store the new address.

Address setting via BootP-mode

The address setting is carried out by a BootP-server in the network after the start-up of the gateway.

In order to activate the BootP-mode, the rotary coding-switches have to be set to "300".

Figure 23: BootP-mode



Note

The IP address as well as the default subnet mask assigned to the gateway by the BootP-server are stored in the gateway's non-volatile memory.

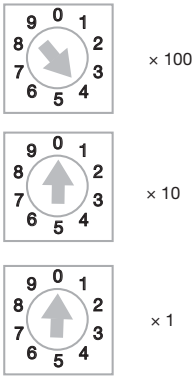
If the gateway is subsequently switched to rotary- or PGM-mode, the settings carried out via BootP (IP address, subnet mask, etc) will be taken from the module's EEPROM.

Address setting via DHCP-mode

The address setting is carried out by a DHCP-server in the network after the start-up of the gateway.

In order to activate the DHCP-mode, the rotary coding-switches have to be set to "400".

Figure 24: DHCP-Modus



Note

The IP address as well as the default subnet mask assigned to the gateway by the DHCP-server are stored in the gateway's non-volatile memory.

If the gateway is subsequently switched to rotary- or PGM-mode, the settings carried out via DHCP (IP address, subnet mask, etc) will be taken from the module's EEPROM.

DHCP supports three mechanisms for IP address allocation:

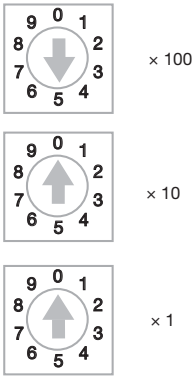
- In "automatic allocation", the DHCP-server assigns a permanent IP address to a client.
- In "dynamic allocation", DHCP assigns an IP address to a client for a limited period of time. After this time or until the client explicitly relinquishes the address, the address can be re-assigned.
- In "manual allocation", a client's IP address is assigned by the network administrator, and DHCP is used simply to convey the assigned address to the client.

Address setting via PGM-mode

The PGM-mode enables the access of I/O-ASSISTANTs to the module's network settings.

In order to activate the PGM-mode, the rotary coding-switches have to be set to "500".

Figure 25: PGM-mode



Note

In the PGM-mode, all network settings (IP address, subnet mask, etc.) are read from the module's internal EEPROM.

The settings carried out in the rotary-mode are stored in the module's non-volatile EEPROM.

Addressing via PGM-DHCP

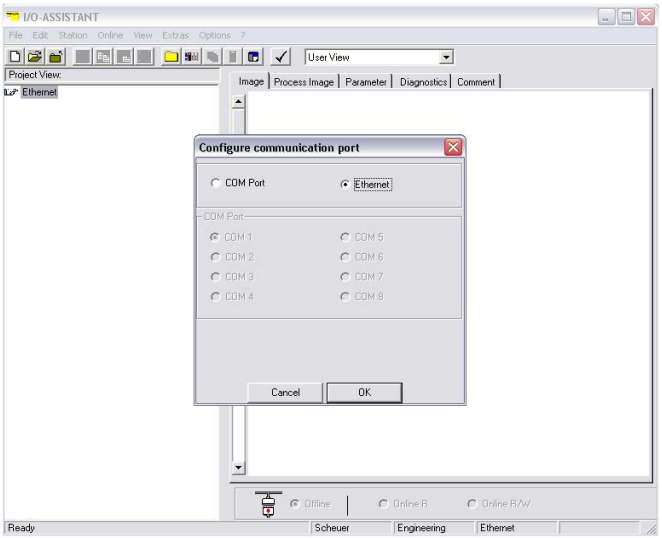
The addressing of the BL67 Modbus TCP gateway via PGM-DHCP is at the moment comparable to the addressing via DHCP (see page 3-19).

Address setting via the software "I/O-ASSISTANT"

The software-tool "I/O-ASSISTANT" enables direct access to the Ethernet-network via the fieldbus cable.

Naturally, the access to the single station via the service interface at the gateway is possible as well.

Figure 26: Interface Ethernet



The IP address as well as the subnet mask of the TURCK Ethernet gateways can be changed according to the application by using the integrated Address Tool.

Changes in the network-configuration are only accepted in the PGM-mode (see page 3-20).

Figure 27: Opening the Address-Tool

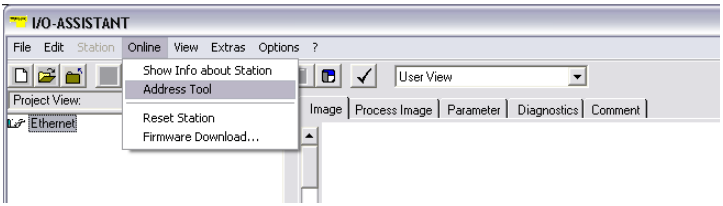
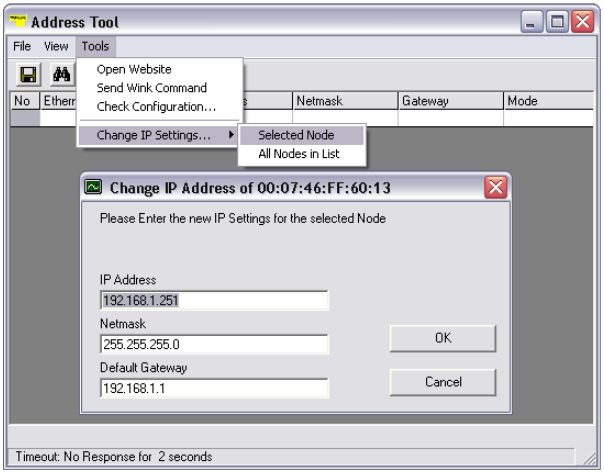


Figure 28: change IP address



Attention

Please observe that, if the system integrated Windows-firewall is activated, difficulties may occur during the communication between the gateway and the Address-tool. The firewall may possibly inhibit the access of the tool on Ethernet.

SET Button

The SET button on the gateway is used to save the Current Configuration of the station as the Reference Configuration in the gateway's non volatile configuration memory.

Note

Please press the SET button for 10 seconds after every change in the station's hardware configuration in order to save the Current Configuration as the Reference Configuration in the Gateway.

Status Indicators/Diagnostic Messages Gateway

The gateway sends the following diagnostic messages:

- undervoltage monitoring for system- and field supply,
- monitoring of the station status,
- monitoring of the communication via the internal module bus,
- monitoring of the communication to Ethernet
- monitoring of the gateway status

Diagnostic messages are displayed in two different ways:

- via the LEDs
- via the respective configuration software

Diagnostic Messages via LEDs

Every BL67 gateway displays the following statuses via LEDs:

- 2 LEDs for module bus communication (module bus LEDs): **GW** and **IO**
- 1 LED for displaying if the gateway/ the program in the gateway has started: **RUN/STOP**
- 3 LEDs for monitoring the voltage supply (system, $\mathbf{V_{CC}}$/ inputs, $\mathbf{V_i}$/ outputs, $\mathbf{V_o}$).
- 2 LEDs for the Ethernet communication (fieldbus-LEDs): **LINK/ ACT** and **MS**.

Table 5: LED-displays

LED	Status	Meaning	Remedy
GW	Off	CPU not supplied.	–
	Green	Firmware active, gateway ready to operate and transmit	–
	Green, flashing, 1 Hz	Firmware not active.	If LED "**IO**" red → Firmware download necessary
	Green, flashing, 4 Hz	Firmware active, gateway hardware defect.	Replace the gateway.
	Red	Controller is not ready, VCC level is not within the required range → possible reasons: – too many modules connected to the gateway – short circuit in connected module – hardware error in gateway	– Check wiring at the gateway and the voltage supply. – Dismount modules – Replace the gateway.

Table 5: LED-displays

LED	Status	Meaning	Remedy
IO	Off	CPU not supplied.	– Check the voltage supply at the gateway.
	Green	Module bus is running, the configured module bus station corresponds to the physically connected station, communication is active.	–
	Green, flashing 1 Hz	Station is in the I/O-ASSISTANT Force Mode.	– Deactivate the I/O-ASSISTANT Force Mode.
	Green, flashing 4 Hz	Maximum number of modules at the gateway is exceeded.	– Check the number of modules connected to the gateway, dismount modules
	Red	Controller is not ready, V_{CC} level is not within the required range → possible reasons: – too many modules connected to the gateway – short circuit in connected module – hardware error in – gateway	– Check wiring at the gateway and the voltage supply. – Dismount modules – Replace the gateway.

Table 5: LED-displays

LED	Status	Meaning	Remedy
IO	Red flashing, 1 Hz	Non-adaptable modification of the physically connected station.	– Compare the planned BL67 station with the physical station. – Check the physical station for defective or incorrectly fitted electronics modules.
	Red flashing, 4 Hz	no module bus communication	– At least one module has to be plugged and has to be able to communicate with the gateway.
	Red/ green flashing, 1 Hz	Adaptable modification of the physically connected station; data transfer possible	– Check the physical station for pulled or new but not planned modules.
RUN/ STOP	Off	No program loaded into the gateway.	–
	Green	Application loaded to gateway, program running.	–
	Green flashing	Application loaded to gateway, PLC not yet started or stopped.	– Start the gateway/ the PLC program.
	Red	PLC test during gateway start.	–
V_{cc}	Off	CPU not supplied	– Check the system supply at the gateway.
	Green	Module bus and CPU running	–

Table 5: LED-displays

LED	Status	Meaning	Remedy
V_O	Off	No voltage supply.	Check the system supply at the gateway.
	Output supply ok.	– Check the wiring at the gateway and the voltage supply.	Green
	Green flashing, 1 Hz	Undervoltage V_O, system running	– Check the system supply at the gateway
	Green flashing, 4 Hz	Overvoltage V_O, system running	
V_I	Off	No voltage supply.	– Check the wiring of the voltage supply at the gateway
	Green	sensor supply ok.	–
	Green, flashing, 1Hz	undervoltage V_I, system running	– Check the wiring of the voltage supply at the gateway
	Green, flashing, 4 Hz	Overvoltage V_I, system running	
	Red	Short circuit or overload at sensor supply → sensor supply is switched off	– Automatic restart when debugging.

Table 5: LED-displays

LED	Status	Meaning	Remedy
LINK/ ACT	Off	No Ethernet link	– Check the Ethernet-connection
	Green	Link, 100 Mbit	–
	Green flashing	Ethernet Traffic, 100 Mbit	–
	Yellow	Link, 10 Mbit	–
	Yellow, flashing	Ethernet Traffic, 10 Mbit	–
MS	Green	Displays the logical connection to a Master (1. Modbus TCP- connection)	–
	Green, flashing	Gateway is ready for operation	–
	Red	Gateway indicates error	–
	Red, flashing	DHCP/BootP search of settings	–

4 Implementation of MODBUS-TCP

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Register 1131h: "Modbus-connection time-out" 12
Register 0×113C and 0×113D:
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Modbus Registers

As soon as an application is downloaded to the BL67-PG-EN, the programmable gateway simply allows read-only-access to the standard Modbus registers (0×0000h to 0×01FFh, 0×0800h to 0×09FFh).

A write-access is only possible using the Modbus output registers (register 0×4400 to 0×47FF, see following table).

Note

If no application is loaded to the BL67-PG-EN, the programmable gateway works as a standard-gateway for MODBUS-TCP.

Note

Some Modbus PLCs and/ or configuration tools do not define register-number 0×0000h as the starting address according to the Modbus specification. In this case, the address area may begin with decimal "1".

Table 6: Modbus registers of the gateway

A *ro = read only*
rw = read write

Address (hex.)	Access A	Description
0×0000 to 0×01FF	ro	packed process data of inputs (process data length of modules, see Table 7: "Data width of the I/O-modules")
0×0800 to 0×09FF	rw	packed process data of outputs (process data length of modules, see Table 7: "Data width of the I/O-modules")
0×1000 to 0×1006	ro	gateway identifier
0×100C	ro	gateway status (see Table 8: "Register 100Ch: gateway-status")
0×1010	ro	process image length in bit for the intelligent output modules
0×1011	ro	process image length in bit for the intelligent input modules
0×1012	ro	process image length in bit for the digital output modules
0×1013	ro	process image length in bit for the digital input modules
0×1017	ro	register-mapping revision (always 1, if not, mapping is incompatible with this description)

Address (hex.)	Access A	Description
0×1018 to 0×101A	ro	group diagnostics of I/O-modules 0 to 32 (1 bit per I/O-module)
0×1020	ro	watchdog, actual time [ms]
0×1120	rw	watchdog predefined time [ms] (default: 0)
0×1121	rw	watchdog reset register
0×1130	rw	modbus connection mode register
0×1131	rw	modbus connection time-out in seconds (default: 0 = never)
0×113C to 0×113D	rw	modbus parameter restore
0×113E to 0×113F	rw	modbus parameter save
0×2000 to 0×207F	rw	service-object, request-area
0×2080 to 0×20FF	ro	service-object, response-area
0×2400	ro	system voltage U_{SYS} [mV]
0×2401	ro	load voltage U_L [mV]
0×2405	ro	load current I_L [A]
0×27FE	ro	no. of entries in actual module list
0×27FF	rw	no. of entries in reference module list
0×2800 to 0×2840	rw	reference module list (32 × 4 bytes per module-ID)
0×2900 to 0×29A0	ro	reserved

A *ro = read only*
rw = read write

Address (hex.)	Access A	Description
0×2A00 to 0×2A20	ro	actual module list (32 × 4 bytes per module-ID)
0x4000 to 0x43FF	rw	Modbus input registers (SPS application-registers, see also "Mapping of the Modbus Registers", page 5-17).
0x4400 to 0x47FF		Modbus output registers Modbus-communication of the programmable gateway with a higher-level Modbus-client (i.e. PLC or OPC-server). See also Figure 29: "Mapping the Modbus registers" or SPS application-registers, "Mapping of the Modbus Registers", page 5-17
0×8000 to 0×8400	ro	process data inputs (32 × 64 bytes)
0×9000 to 0×9400	rw	process data outputs (32 × 64 bytes)
0×A000 to 0×A400	ro	diagnostics (32 × 64 bytes)
0×B000 to 0×B400	rw	parameters (32 × 64 bytes)

A *ro = read only*
rw = read write

Structure of the Packed In-/ Output Process Data

In order to assure a largely efficient access to the process data of a station, the module data are consistently packed and mapped to a coherent register area.

The I/O-modules are divided into digital and intelligent modules (analog modules, serial interfaces).

Both module types are mapped in separate register ranges.

The data mapping always starts with the mapping of the intelligent modules. Each module occupies as much Modbus registers as necessary, depending on it's data width. At least one register is occupied. A RS232-module, for example, occupies 4 consecutive registers (8 bytes) in the input and in the output area.
The data byte arrangement is done according to the physical order in the station, from the left to the right.

The data of the intelligent modules are followed by the data of the digital modules, also structured according to their physical appearance in the station. The Modbus registers for the digital data are filled-up up to 16 bit. This means on the one hand that one Modbus register can contain data of different digital modules and on the other hand that the data of one digital module can be distributed over multiple registers. Bit 0 of a digital module is thus not obligatory located on a word limit.

Packed input-process data

- input register area: **0000h** to **01FFh**

0000h			**01FFh**
intelligent modules, input data	digital input modules	status/ diagnosis	free

Note

Independent of the I/O-configuration, an access to all 512 registers is always possible. Registers that are not used send "0".

Status/ diagnosis

The area "status/diagnosis" comprises a maximum of 9 registers.

The first register contains a common gateway-/station-status.

The following registers (max. 8) contain a group diagnostic bit for each I/O-module which shows whether a diagnostic message is pending for the relevant module or not.

Status/ diagnosis	
n + 0000h	**n + 0008h**
gateway status (Reg. 100Ch)	group diagnosis I/O-modules 0...127 (registers 1018h to 101Fh)

Packed output process data

- output register area: **0800h** to **09FFh**

0800h		**09FFh**
intelligent modules, output data	digital output data	free

Note

Independent of the I/O-configuration, an access to all 512 registers is always possible. Registers that are not used send "0" answering a read access, write accesses are ignored.

Data Width of the I/O-Modules in the Modbus-Register Area

The following table shows the data width of the BL67 I/O-modules within the modbus register area and the type of data alignment.

Table 7: Data width of the I/O-modules

Module	Process input	Process output	Alignment
– digital inputs			
BL67-4DI-x	4 bit	-	bit by bit
BL67-8DI-x	8 bit	-	bit by bit
– digital outputs			
BL67-4DO-x	-	4 bit	bit by bit
BL67-8DO-x	-	8 bit	bit by bit
BL67-16DO-x	-	16 bit	bit by bit
– analog inputs			
BL67-2AI-x	2 words		word by word
– analog outputs			
BL67-2AO-x		2 words	word by word
– technology modules			
BL67-1RS×××	4 words	4 words	word by word
BL67-1SSI	4 words	4 words	word by word
BL67-1CVI	4 words	4 words	word by word

Register 100Ch: "Gateway-Status"

This register contains a general gateway-/ station-status.

Table 8: Register 100Ch: gateway-status

Bit	Name	Description
Gateway		
15	I/O Controller Error	The communication controller for the I/O-system is faulty.
14	Force Mode Active Error	The Force-Mode it activated. The state of the outputs may no longer accord to the settings made via the fieldbus.
13	reserved	-
12	Modbus Wdog Error	A time-out in the Modbus communication occurred.
Module bus		
11	I/O Cfg Modified Error	The I/O-configuration has been changed and is now incompatible.
10	I/O Communication Lost Error	No communication on the I/O-module bus.

Bit	Name	Description
Voltage errors		
9	V_I too low	System supply voltage too low (< 18 VDC).
8	V_I too high	System supply voltage too high (> 30 VDC).
7	V_O too low	Load voltage too low (< 18 VDC).
6	V_O too high	Load voltage too high (> 30 V).
5	I_{sys} too high	Overload of the system voltage supply.
4	reserved	-
Warnings		
3	I/O Cfg Modified Warning	
0	I/O Diags Active Warning	At least one I/O-module sends active diagnostics.

Register 1130h: "Modbus-connection-mode"

This register defines the behavior of the Modbus connections:

Table 9: register 1130h: Modbus-Connection-Mode

Bit	Name	Description
15 to 2	reserved	
1	**MB_ImmediateWritePermission**	– 0: With the first write access, a write authorization for the respective Modbus-connection is requested. If this request fails, an exception response with exception-code 01h is generated. If the request is accepted, the write access is executed and the write authorization remains active until the connection is closed. – 1:The write authorization for the respective Modbus-connection is already opened during the establishment of the connection. The first Modbus-connection thus receives the write authorization, all following connections don't (only if bit 0 = 1).
0	**MB_OnlyOneWritePermission**	– 0: all Modbus-connections receive the write authorization – 1: only one Modbus-connection can receive the write permission. A write permission is opened until a Disconnect. After the Disconnect the next connection which requests a write access receives the write authorization.

Register 1131h: "Modbus-connection time-out"

This register defines after which time of inactivity a Modbus-connection is closed through a Disconnect.

Register 0×113C and 0×113D: "Restore Modbus-connection parameter"

Registers 0×113C and 0×113D serve for resetting the parameter-register 0×1120 and 0×1130 to 0×113B to the default settings.

For this purpose, write "0×6C6F" in register 0×113C. To activate the reset of the registers, write "0×6164" ("load") within 30 seconds in register 0×113D.

Both registers can also be written with one single request using the function codes FC16 and FC23.

The service resets the parameters without saving them. This can be achieved by using a following "save" service.

Register 0×113E and 0×113F:
"Save Modbus-connection parameters"

Registers 0×113E and 0×113F are used for the non-volatile saving of parameters in registers 0×1120 and 0×1130 to 0×113B.

For this purpose, write "0×7361" in register 0×113E. To activate the saving of the registers, write "0×7665" ("save") within 30 seconds in register 0×113F.

Both registers can also be written with one single request using the function codes FC16 and FC23.

The Service-Object

The service-object is used to execute one-time or acyclic services. It is an acknowledge service which may serve, for example, to parameterize an I/O-module.

2000h	2080h	20FFh
service request area	service response area	

The service request area allows write access, the service response area only read access.

- Service request area

2000h	2001h	2002h	2003h	2004h	2005h	20FFh
service no.	reserved	service code	index/ addr	data-reg-count	optional data (0 to122 registers)	

The register **service no.** in the request area can contain a user defined value which is deleted after the execution of the service.

The register **service code** specifies which service is requested.

The register **index/addr** is optional and the meaning depends on the particular service.

The register **data-reg-count** contains, depending on the service, the number (0 to 122) of the transferred or of the requested data registers.

Depending on the service, the **optional data** area can contain additional parameters and/or other data to be written.

- Service response area

2080h	2081h	2082h	2083h	2084h	2085h	20FFh
service no.	result	service code	index/ addr	data-reg-count	optional data (0 to 122 registers)	

After the execution of a request, the registers **service-no.**, **service code** and **index/addr** in the response area contain a copy of the values in the request area.

Note

The service no. is thus used for a simple handshake on the application level. The application increases the service no. with every request. The service is blocked, until the service number in the request area matches the service number in the response area.

The register **result** shows whether the execution was successful or not.

The register **data-reg-count** contains the number of data registers (0 to 122).

The **optional Data** area can contain, depending on the service, the requested data.

Supported service numbers::

Table 10: Supported service numbers:

Service code	Meaning
0×0000	no function
0×0003	indirect reading of registers
0×0010	indirect writing of registers

A service request may have the following results:

Table 11: results of the service request

Service code	Meaning
0×0000	error free execution of service
0×FFFE	service parameters incorrect/ inconsistent
0×FFFF	service code unknown

Note

The services "indirect reading of registers" and "indirect writing of registers " offer an additional possibility to access any Modbus register.

Current Modbus-masters support only a limited number of register-areas that can be read or written during the communication with a Modbus-server. These areas can not be changed during operation.

In this case, the services mentioned above enables non-cyclic access to registers.

"Indirect reading of registers"

1 to 122 (Count) Modbus-registers are read, starting with address x (Addr).

- service-request

2000h	2001h	2002h	2003h	2004h	2005h	207Fh
service no.	0x0000	0x0003	Addr	Count	reserved	

- service-response

2080h	2081h	2082h	2083h	2084h	2085h	20FFh
service no.	result	0x0003	Addr	Count	register contents	

"Indirect writing of registers"

1 to 122 (Count) Modbus-registers are written, starting with address x (Addr).

- service-request

2000h	2001h	2002h	2003h	2004h	2005h	207Fh
service no.	0x0000	0x0010	Addr	Count	register contents	

- service-response

2080h	2081h	2082h	2083h	2084h	2085h	20FFh
service no.	result	0x0010	Addr	Count	reserved	

Mapping: Input-Discrete- and Coil-Areas

Function codes FC1 ("Read Coils"), FC2 ("Read Discrete Inputs"), FC 5 ("Write Single Coil") and FC15 ("Write Multiple Coils") allow single-bit access to in- and output data.

The data mapping in these areas is the following:

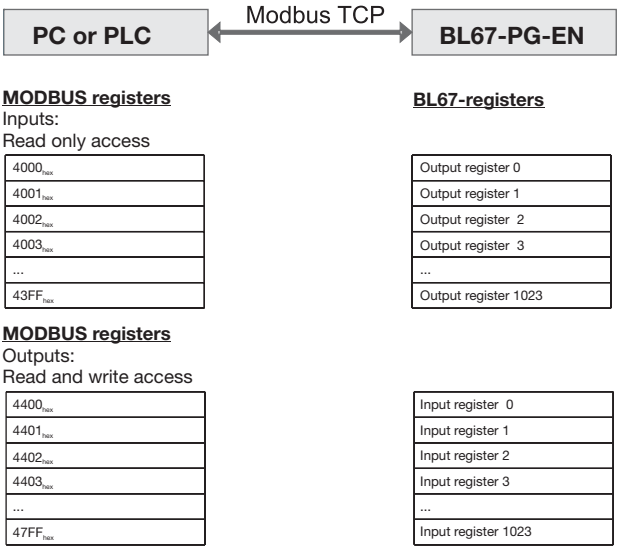
- Mapping: input-discrete-area
  All digital inputs are stored in this area (offset "0").
- Mapping: Coil-area
  All digital outputs are stored in this area (offset "0").

Note

In addition to that, digital in- and outputs can also be accessed via the packed process data, page 4-7 within the Modbus registers of the gateway.
In the Modbus registers, the digital I/O data are stored with a variable offset, depending on the station's I/O-configuration.

Mapping the Modbus Registers

Figure 29: Mapping the Modbus registers



Implemented Modbus Functions

The BL67 gateway for Ethernet supports the following functions for accessing process data, parameters, diagnostics and other services.

Table 12: Implemented functions

Function Codes	
No.	**Function** Description
1	**Read Coils** Serves for reading multiple output bits.
2	**Read Discrete InputS** Serves for reading multiple input bits
3	**Read Holding Registers** Serves for reading multiple output registers
4	**Read Input Registers** Serves for reading multiple input registers
5	**Write Single Coil** Serves for writing single output bits
6	**Write Single Register** Serves for writing single output registers
15	**Write Multiple Coils** Serves for writing multiple output bits
16	**Write Multiple Registers** Serves for writing multiple output registers
23	**Read/Write Multiple Registers** Serves for reading and writing multiple registers

Parameters of the Modules

Digital input modules

- BL67-4DI-PD

Table 13: Module parameters

A *Default-setting*

Byte	Bit	Parameter name	Value – **Meaning**
0	0 to 3	input filter channel 0 to 3	0 = deactivate **A:** – input filter: 0,25 ms.
			1 = activate: – input filter: 2,5 ms
1	0 to 3	digital input channel 0 to 3	0 = normal **A:** – input signal not inverted.
			1 = inverted: – input signal inverted, conversion of the effective signal direction for sensors
2	0, 1	operation mode group 1/ 2	0 = normal
			1 = open circuit monitoring Group A (channel 0 and 2) Group B (channel 2 and 3).

- BL67-8DI-PD

Table 14: Module parameters

A *Default-settings*

Byte	Bit	Parameter name	Value – Meaning
0	0 to 7	input filter channel 0 to 7	0 = deactivate **A:** – input filter: 0,25 ms.
			1 = activate: – input filter: 2,5 ms
1	0 to 7	digital input channel 0 to 7	0 = normal **A:** – input signal not inverted.
			1 = inverted: – input signal inverted, conversion of the effective signal direction for sensors
2	0, 1, 2, 3	operation mode group 1 to 4	0 = normal
			1 = open-circuit monitoring: Group A (channel 0 and 4) Group B (channel 1 and 5) Group C (channel 3 and 6) Group D (channel 4 and 7).

Analog input modules

- BL67-2AI-I (1 byte parameter per channel)

Table 15: Module parameters

A *Default-settings*

Byte	Bit	Parameter name	Value – Meaning
0/1	0	current mode	0 = 0...20 mA **A**
			1 = 4...20 mA
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left justified)
	2	diagnosis	0 = activate **A**
			1 = deactivate
	3	channel	0 = activate **A**
			1 = deactivate

- BL67-2AI-V (1 byte parameter per channel)

Table 16: Module parameters

A *Default-settings*

Byte	Bit	Parameter name	Value – Meaning
0/1	0	voltage mode	0 = 0...10 V **A**
			1 = -10...+10 V
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left justified)
	2	diagnosis	0 = activate **A**
			1 = deactivate
	3	channel	0 = activate **A**
			1 = deactivate

- BL67-2AI-PT (2 byte parameter per channel)

Table 17: Module parameters

A *Default-settings*

Byte	Bit	Parameter name	Value – Meaning
0/2	0	mains suppression	0 = 50 Hz **A**
			0 = 60 Hz
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left justified)
	2	diagnosis	0 = release **A**
			1 = block
	3	channel	0 = activate **A**
			1 = deactivate
	7 to 4	element	0000 = PT100, -200...850 °C**A** 0001 = PT100, -200...150 °C 0010 = NI100, -60...250 °C 0011 = NI100, -60...150 °C 0100 = PT200, -200...850 °C 0101 = PT200, -200...150 °C 0110 = PT500, -200...850 °C 0111 = PT500, -200...150 °C 1000 = PT1000, -200...850 °C 1001 = PT1000, -200...150 °C 1010 = NI1000, -60...250 °C 1011 = NI1000, -60...150 °C 1100 = resistance, 0...100 Ω 1101 = resistance, 0...200 Ω 1110 = resistance, 0...400 Ω 1111 = resistance, 0...1000 Ω
1/3	0	measurement mode	0 = 2-wire **A**
			1 = 3-wire

- BL67-2AI-TC (2 byte parameter per channel)

Table 18: Module parameters

A *Default-settings*

Byte	Bit	Parameter name	Value – Meaning
0/1	0	mains suppression	0 = 50 Hz **A**
			0 = 60 Hz
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left justified)
	2	diagnosis	0 = release **A**
			1 = block
	3	channel	0 = activate **A**
			1 = deactivate
	7 to 4	element	0000 = type K, -270...1370 °C**A** 0001 = type B, +100...1820 °C 0010 = type E, -270...1000 °C 0011 = type J, -210...1200 °C 0100 = type N, -270...1300 °C 0101 = type R, -50...1760 °C 0110 = type S, -50...1540 °C 0111 = type T, -270...400 °C 1000 = ± 50 mV 1001 = ± 100 mV 1010 = ± 500 mV 1011 = ± 1000 mV ... reserved

- BL67-4AI-V/I (1 byte parameter per channel)

Table 19: Module parameters

A *Default-settings*

Byte	Bit	Parameter name	Value – Meaning
0 to 3	0	range	0 = 0...10 V/ 0...20 mA **A**
			1 = -10...+10 V/ 4...20 mA
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left justified)
	2	diagnosis	0 = release **A**
			1 = block
	3	channel	0 = activate **A**
			1 = deactivate
	4	operation mode	0 = voltage **A**
			1 = current

Digital output modules

- BL67-16DO-0.1A-P

Tabelle 20: Module parameters

A *default-settings*

Byte	Bit	Parameter name	Value – **Meaning**
0	0	Open circuit current LSB (Channel 0 to 7)	0 to 12 **A** – current below which an open circuit diagnosis is generated: "Value" × 10 mA
	1 + 2	reserved	
	3	Open circuit current MSB (Channel 8 to 15)	0 to 12 **A** – current below which an open circuit diagnosis is generated: "Value" × 10 mA
	4	Short-circuit current LSB (Channel 0 to 7)	0 **A** to 12 – current above which a short-circuit diagnosis is generated: "Value" × 10 mA.
	5 + 6	reserved	
	7	Short-circuit current MSB (Channel 8 to 15)	0 **A** to 12 – current above which a short-circuit diagnosis is generated: "Value" × 10 mA.
1	0	DiaOverCur	0 = short-circuit diagnosis off
			1 = short-circuit diagnosis on **A**
	1	DiaOpeLoa	0 = open circuit diagnosis off **A**
			1 = open circuit diagnosis on
	2 to 7	reserved	

Analog output modules

- BL67-2AO-I

Table 21: Module parameters

A *Default-settings*

Byte	Bit	Parameter name	Value – Meaning
0	0	current mode	0 = 0...20 mA **A**
			1 = 4...20 mA
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left justified)
	2	reserved	
	3	channel	0 = activate **A**
			1 = deactivate
	4 to 7	reserved	
1		substitute value low byte	The substitute value will be transmitted if the respective parameters of the gateway have been set to "output substitute value".
2		substitute value high byte	

- BL67-2AO-V

Table 22: Module parameters

A *Default-settings*

Byte	Bit	Parameter name	Value – Meaning
0	0	voltage mode	0 = 0...10 V **A**
			1 = -10...+10 V
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left justified)
	2	reserved	
	3	channel	0 = activate **A**
			1 = deactivate
	4 to 7	reserved	
1		substitute value low byte	The substitute value will be transmitted if the respective parameters of the gateway have been set to "output substitute value".
2		substitute value high byte	

Digital combi modules

- BL67-4DI4DO-PD

Table 23: Module parameters

A *Default-settings*

Byte	Bit	Parameter name	Value – Meaning
0	0 to 3	input filter channel 0 to 3	0 = deactivate **A:** – input filter: 0,25 ms.
			1 = activate: – input filter: 2,5 ms
1	0 to 3	digital input channel 0 to 3	0 = normal **A:** – input signal not inverted.
			1 = inverted: – input signal inverted, conversion of the effective signal direction for sensors
2	0 to 3	output at overcurrent channel 4 to 7	0 = automatic recovery **A:** – the output switches-on automatically after a short-circuit
			1 = controlled recovery: – the output is manually switched-off and on again.

- BL67-8XSG-PD

Table 24: Module parameters

A *Default-settings*

Byte	Bit	Parameter name	Value – **Meaning**
0	0 to 7	input filter channel 0 to 7	0 = deactivate **A:** – input filter: 0,25 ms.
			1 = activate: – input filter: 2,5 ms
1	0 to 7	digital input channel 0 to 7	0 = normal **A:** – input signal not inverted.
			1 = inverted: – input signal inverted, conversion of the effective signal direction for sensors
2	0 to 7	output at overcurrent channel 0 to 7	0 = automatic recovery **A:** – the output switches-on automatically after a short-circuit
			1 = controlled recovery: – the output is manually switched-off and on again.
3	0 to 7	output	0 = deactivate
			1 = activate: – selective activation of outputs of the module

Technology modules

- BL67-1RS232

Table 25: Module parameters

A *Default-settings*

Byte	Bit	Parameter name	Value – Meaning
0	3 to 0	data rate	0000 = 300 bps 0001 = 600 bps 0010 = 1200 bps 0100 = 2400 bps 0101 = 4800 bps 0110 = 9600 bps **A** 0111 = 14400 bps 1000 = 19200 bps 1001 = 28800 bps 1010 = 38400 bps 1011 = 57600 bps 1100 = 115200 bps ... reserved
	5,4	reserved	-
	6	Disable ReducedCtrl	Constant setting: – The diagnosis messages are set in Byte 6 of the process input data (independent of "diagnostic"). Byte 6 of the process output data contains two bits which may set to flush the transmit- or the receive-buffer. – Byte 7 contains the status- or the control-byte. – Bytes 0 to 5 contain the user data.
	7	diagnosis	0 = release **A** 1 = block

A *Default-settings*

Byte	Bit	Parameter name	Value – **Meaning**
1	0	stop bits	0 = 1 bit **A**
			1 = 2 bit
	2,1	parity	00 = none
			01 = odd **A** – The number of the bits set (data bits and parity bit) is odd.
			10 = even – The number of the bits set (data bits and parity bit) is even.
	3	data bits	0 = 7 **A** – The number of data bits is 7.
			1 = 8 – The number of data bits is 8.
	5,4	data flow control	00 = none **A** – the data flow control is deactivated
			01 = XON/XOFF – Software-Handshake (XON/XOFF) is activated
			10 = RTS/CTS – Hardware-Handshake (RTS/CTS) is activated.
	7,6	reserved	
2		XON-character	This character is used to start the data transfer of the data terminal device (DTE) when the software-handshake is activated
3		XOFF-character	This character is used to stop the data transfer of the data terminal device (DTE) when the software-handshake is activated

- BL67-1RS485/422

Table 26: Module parameters

A *Default-settings*

Byte	Bit	Parameter name	Value – **Meaning**
0	3 to 0	data rate	0000 = 300 bps 0001 = 600 bps 0010 = 1200 bps 0100 = 2400 bps 0101 = 4800 bps 0110 = 9600 bps **A** 0111 = 14400 bps 1000 = 19200 bps 1001 = 28800 bps 1010 = 38400 bps 1011 = 57600 bps 1100 = 115200 bps ... reserved
	4	Select RS485	0 = – parameterization as RS4222
			1 = – parameterization as RS485
	5	reserved	
	6	Disable ReducedCtrl	Constant setting: – The diagnosis messages are set in Byte 6 of the process input data (independent of "diagnostic"). Byte 6 of the process output data contains two bits which may set to flush the transmit- or the receive-buffer. – Byte 7 contains the status- or the control-byte. – Bytes 0 to 5 contain the user data.

A *Default-settings*

Byte	Bit	Parameter name	Value – **Meaning**
0	7	diagnosis	0 = release **A**
			1 = block
1	0	stop bits	0 = 1 bit **A**
			1 = 2 bit
	2,1	parity	00 = none
			01 = odd **A** – The number of the bits set (data bits and parity bit) is odd.
			10 = even – The number of the bits set (data bits and parity bit) is even.
	3	data bits	0 = 7 **A** – The number of data bits is 7.
			1 = 8 – The number of data bits is 8.

- BL67-1SSI

Table 27: Module parameters

A *Default-settings*

Byte	Bit	Parameter name	Value – **Meaning**
0	4 to 0	reserved	
	5	Encoder data cable test	0 = activate **A** – ZERO test of data cable.
			0 = deactivate – After the last valid bit, a ZERO test of the data cable is not carried out.
	7,6	reserved	
1	3 to 0	Number of invalid bits (LSB)	0000 to 1111: Number of invalid bits on the LSB side of the position value supplied by the SSI encoder. The meaningful word width of the position value transferred to the module bus master is as follows: SSI_FRAME_LEN - INVALID_BITS_MSB - INVALID_ BITS_LSB. The invalid bits on the LSB side are removed by shifting the position value to the right, starting with the LSB.(Default 0 bit = 0x 0). INVALID_BITS_MSB +INVALID_BITS_LSB must always be less than SSI_FRAME_LEN.

A *Default-settings*

Byte	Bit	Parameter name	Value – **Meaning**
1	6 to 4	Number of invalid bits (MSB)	Number of invalid bits on the MSB side of the position value supplied by the SSI encoder. The meaningful word width of the position value transferred to the module bus master is as follows: SSI_FRAME_LEN - INVALID_BITS_MSB - INVALID_BITS_LSB. The invalid bits on the MSB side are zeroed by masking the position value. INVALID_BITS_MSB + INVALID_BITS_LSB must always be less than SSI_FRAME_LEN. Default: 0 = 0hex
	7	reserved	
2	3 to 0	data rate	0000 = 1000000 bps 0001 = 500000 bps **A** 0010 = 250000 bps 0011 = 125000 bps 0100 = 100000 bps 0101 = 83000 bps 0110 = 71000 bps 0111 = 62500 bps ... reserved
	7 to 4	reserved	

	Byte	Bit	Parameter name	Value – **Meaning**
A *Default-settings*	3	5 to 0	data frame bits	00000 to 100000 Number of bits of the SSI data frame. SSI_FRAME_LEN must always be greater than INVALID_BITS. Default: 25 = 19hex
		6	reserved	
		7	data format	binary coded **A** – SSI encoder sends data in binary code
				GRAY coded – SSI encoder sends data in Gray code

- BL67-1CVI

Table 28: Parameter BL67-1CVI

Parameter name	Meaning
CfgNode 1	Configuration of the first connected node (see Table 29:)
...	
CfgNode 8	Configuration of the eighth connected node (see Table 29:)
GuardTime	Setting the guard time in steps of 100ms (default 3 = 300 ms)
Life Time Factor	default 3
Config	Different configuration settings (see Table 30:)

Table 29: Configuration possibilities of the CANopen-Nodes

Bit	Parameter name	Value – Meaning
0	NodeActive	0 = inactive/ not present **A** 1 = active
1	NodeGuarding	0 = inactive **A** 1 = active – Node guarding is activated.
2 to 4	InLen	000 = 0 bit **A** 001 = 4 bit 010 = 8 bit 011 = 12 bit 100 = 16 bit 101 = 24 bit 110 = 32 bit 111 = reserved
5 to 7	OutLen	000 = 0 bit **A** 001 = 4 bit 010 = 8 bit 011 = 12 bit 100 = 16 bit 101 = 24 bit 110 = 32 bit 111 = reserved

Table 30: Configuration possibilities for CANopen

Bit	Parameter name	Value Meaning
0 to 2	BaudRate	000 = 1000 k 001 = reserved 010 = 500 k 011 = 250 k 100 = 125 k **A** 101 = 50 k 110 = 20 k 111 = 10 k
3	Termination	0 = no terminating resistor **A** 1 = terminating resistor active – Activation of the terminating resistor.
4 to 7	reserved	

Diagnostic Messages of the Modules

Power supply modules

- BL67-PF-24VDC

Table 31: BL67-PF-24VDC

Diagnostic byte	Bit	Diagnostic message
n	0	undervoltage V_I
	1	undervoltage V_O
	2	overcurrent I_I (current consumption too high)

Digital input modules

- BL67-4DI-PD

Table 32: BL67-4DI-PD

Diagnostic byte	Bit	Diagnostic message
n	0	overcurrent sensor 1 (channel 0)
	1	overcurrent sensor 2 (channel 1)
	2	overcurrent sensor 3 (channel 2)
	3	overcurrent sensor 4 (channel 3)
n + 1	0	open circuit K1 (channel 0 and 2)
	1	open circuit K2 (channel 1 and 3)

- BL67-8DI-PD

Table 33: BL67-8DI-PD

Diagnostic byte	Bit	Diagnostic message
n	0	overcurrent sensor 1 (sensor supply A)
	1	overcurrent sensor 2 (sensor supply B)
	2	overcurrent sensor 3 (sensor supply C)
	3	overcurrent sensor 4 (sensor supply D)
n + 1	0	open circuit K1 (Channel 0 and 4)
	1	open circuit K2 (Channel 1 and 5)
	2	open circuit K3 (Channel 2 and 6)
	3	open circuit K4 (Channel 3 and 7)

Analog input modules

- BL67-2AI-I

Table 34: BL67-2AI-I

A *only detected when the current range is set from 4 to 20 mA.*

Diagnostic byte	Bit	Diagnostic message
n (channel 0)	0	measurement range error **A**
	1	open circuit
n + 1 (channel 1)	0	measurement range error **A**
	1	open circuit

- BL67-2AI-V

Table 35: BL67-2AI-V

Diagnostic byte	Bit	Diagnostic message
n (channel 0)	0	measurement range error
n + 1 (channel 1)	0	measurement range error

- BL67-2AI-PT

Table 36: BL67-2AI-PT

A *Threshold: 1% of positive measurement range end value.*
B *Threshold: 5 Ω (loop resistance)*

Diagnostic byte	Bit	Diagnostic message
n (channel 0)	0	measurement range error **A** (Underflow diagnostic only in the temperature measurement range.)
	1	open circuit
	2	short-circuit **B** (Only with temperature measurements)
n + 1 (channel 1)	0 to 7	similar to channel 0

- BL67-2AI-TC

Table 37: BL67-2AI-TC

A *Threshold: 1% of positive measurement range end value.*
B *Threshold: 5 Ω (loop resistance)*

Diagnostic byte	Bit	Diagnostic message
n	0	measurement range error
	1	open circuit **B** (Only with temperature measurements)
	3	No PT1000 sensor found (cold junction compensation)
	4 to 7	reserved
n + 1 (channel 1)	0 to 7	similar to channel 0

- BL67-4AI-V/I

Table 38: BL67-4AI-V/I

Diagnostic byte	Bit	Diagnostic message
n (channel 0)	0	measurement range error
n + x (channel 1 to 3)	0	measurement range error

Digital output modules

- BL67-4DO-0.5A-P

Table 39: BL67-4DO-0.5A-P

Diagnostic byte	Bit	Diagnostic message
n	0	overcurrent (short-circuit channel 0)
	1	overcurrent (short-circuit channel 1)
	2	overcurrent (short-circuit channel 2)
	3	overcurrent (short-circuit channel 3)

- BL67-4DO-2A-P

Table 40: BL67-4DO-2A-P

Diagnostic byte	Bit	Diagnostic message
n	0	overcurrent (short-circuit channel 0)
	1	overcurrent (short-circuit channel 1)
	2	overcurrent (short-circuit channel 2)
	3	overcurrent (short-circuit channel 3)

- BL67-8DO-0.5A-P

Table 41: BL67-8DO-0.5A-P

Diagnostic byte	Bit	Diagnostic message
n	0	overcurrent (short-circuit channel 0)
	1	overcurrent (short-circuit channel 1)
	2	overcurrent (short-circuit channel 2)
	3	overcurrent (short-circuit channel 3)
	4	overcurrent (short-circuit channel 4)
	5	overcurrent (short-circuit channel 5)
	6	overcurrent (short-circuit channel 6)
	7	overcurrent (short-circuit channel 7)

- BL67-16DO-0.1A-P

Tabelle 5: BL67-16DO-0.1A-P

Diagnose-Byte	Bit	Diagnose
n	0	Short-circuit or/ and open circuit channel 0
	1	Short-circuit or/ and open circuit channel 1
	...	...
	6	Short-circuit or/ and open circuit channel 6
	7	Short-circuit or/ and open circuit channel 7
n + 1	0	Short-circuit or/ and open circuit channel 8
	1	Short-circuit or/ and open circuit channel 9
	...	...
	6	Short-circuit or/ and open circuit channel 14
	7	Short-circuit or/ and open circuit channel 15

- BL67-4DO-2A-N

Table 42: BL67-4DO-2A-N

Diagnostic byte	Bit	Diagnostic message
n	0	overcurrent (short-circuit channel 0)
	1	overcurrent (short-circuit channel 1)
	2	overcurrent (short-circuit channel 2)
	3	overcurrent (short-circuit channel 3)

- BL67-8DO-0.5A-N

Table 43: BL67-8DO-0.5-N

Diagnostic byte	Bit	Diagnostic message
n	0	overcurrent (short-circuit channel 0)
	1	overcurrent (short-circuit channel 1)
	2	overcurrent (short-circuit channel 2)
	3	overcurrent (short-circuit channel 3)
	4	overcurrent (short-circuit channel 4)
	5	overcurrent (short-circuit channel 5)
	6	overcurrent (short-circuit channel 6)
	7	overcurrent (short-circuit channel 7)

Digital combi modules

- BL67-4DI4DO-PD

Table 44: BL67-4DI4DO-PD

Diagnostic byte	Bit	Diagnostic message
n	0	overcurrent sensor 1 (input 0)
	1	overcurrent sensor 2 (input 1)
	2	overcurrent sensor 3 (input 2)
	3	overcurrent sensor 4 (input 3)
n + 1	0	overcurrent K1 (output 0)
	1	overcurrent K2 (output 1)
	2	overcurrent K3 (output 2)
	3	overcurrent K4 (output 3)

- BL67-8XSG-PD

Table 45: BL67-8XSG-PD

Diagnostic byte	Bit	Diagnostic message
n	0	overcurrent sensor 1 (sensor supply A)
	1	overcurrent sensor 2 (sensor supply B)
	2	overcurrent sensor 3 (sensor supply C)
	3	overcurrent sensor 4 (sensor supply D)
n + 1	0	overcurrent K1 (channel 0)
	1	overcurrent K2 (channel 1)
	2	overcurrent K3 (channel 2)
	3	overcurrent K4 (channel 3)
	4	overcurrent K5 (channel 4)
	5	overcurrent K6 (channel 5)
	6	overcurrent K7 (channel 6)
	7	overcurrent K8 (channel 7)

Technology modules

- BL67-1RS232

Table 46: BL67-1RS232

Diagnostic byte	Bit	Diagnostic message
n	3	parameterization error
	4	hardware failure
	5	data flow control error
	6	frame error
	7	buffer overflow

- BL67-1RS485/422

Table 47: BL67-1RS485/422

Diagnostic byte	Bit	Diagnostic message
n	3	parameterization error
	4	hardware failure
	6	frame error
	7	data flow control error

- BL67-1SSI

Table 48: BL67-1SSI

Diagnostic byte	Bit	Diagnostic message
n	0	SSI group diagnostics
	1	open circuit
	2	sensor value overflow
	3	sensor value underflow
	4	parameterization error

- BL67-1CVI

Table 49: Diagnosis data BL67-1CVI

Diagnostic byte	Bit	Diagnostic message
n	0 to 3	DiagNode1 (see Table 50:)
	4 to 7	DiagNode 2 (see Table 50:)
...	...	...
n + 3	0 to 3	DiagNode 7 (see Table 50:)
	4 to 7	DiagNode 8 (see Table 50:)
n + 4		DiagCVI (see Table 51:)
n + 5		reserved

Table 50: Diagnosis data CANopen-Node (DiagNode x)

Bit	Meaning
0	Emergencies transmitted since module start.
1	Node transmitted emergencies
2	Communication error transmitted since module start/ Guard Time
3	Communication error/Guard Time timeout

Table 51: Global diagnosis CVI-module (DiagCVI)

Bit	Meaning
0	Emergencies transmitted since module start
1	Node address not within permissible range (1-8)
2	Overcurrent VC (valve power supply)
3	Overcurrent VE (valve electronic power supply)

5 Configuration of the programmable gateway with CoDeSys

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General

This chapter describes the configuration of a BL67 station with the programmable BL67 gateway for MODBUS-TCP in CoDeSys (Controller Development System) from "3S - Smart Software Solutions GmbH" on the basis of an example.

System requirements

- Installation of CoDeSys (version 2.3.5.8)
- Installation of the BL67 target files "TSP_Turck_×××.zip" (can be downloaded from www.turck.com)

Figure 30: CoDeSys from 3S

CoDeSys
The IEC 61131-3 Programming System
Version 2.3.5.8 Build Dec 7 2005)
© Copyright 1994-2005 by 3S - Smart Software Solutions GmbH
Smart Software Solutions
3S - We software Automation.

Installation of the BL67 target files

Before configuring the BL67 station with CoDeSys and programming the BL67-PG-EN, the BL67 Target Support Package (short: targets) have to be installed.

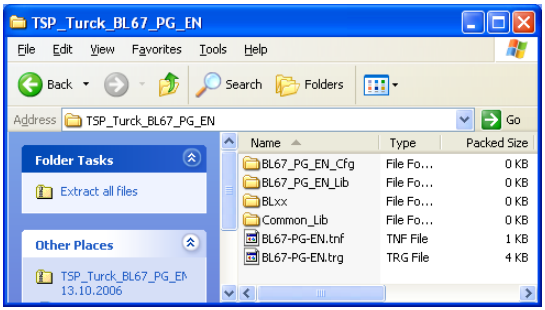
Target files contain all information necessary for integrating a system into the programming tool.

The Target Support Package (TSP) for the BL67-PG-EN can be downloaded from the TURCK homepage as a zipped archive (TSP_Turck_BL67_PG_EN ×××.zip).

This archive contains the target file and other manufacturer specific files like libraries etc. which are necessary for the operation of the gateway at CoDeSys.

The files have to be stored on your PC showing following directory structure:

Figure 31: Directory structure of the target file



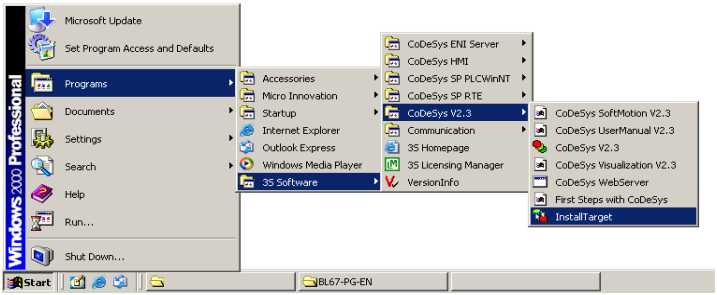
Note

Please observe, that the files have to be stored in this directory structure after having been extracted from the *.zip-file. Otherwise, problems may occur during the target installation.

Installation

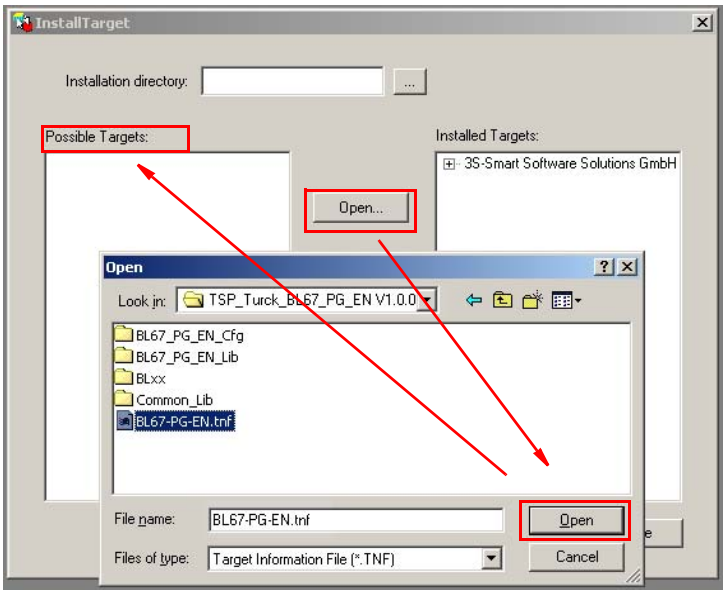
The target installation in CoDeSys is done using the "Start → Programs→ 3S Software → CoDeSys → V2.3 → Install Target"-command.

Figure 32: Install Target



Search the target information file "BL67-×××.tnf" using the „Open“ button and add the TURCK gateways to „Possible Targets“.

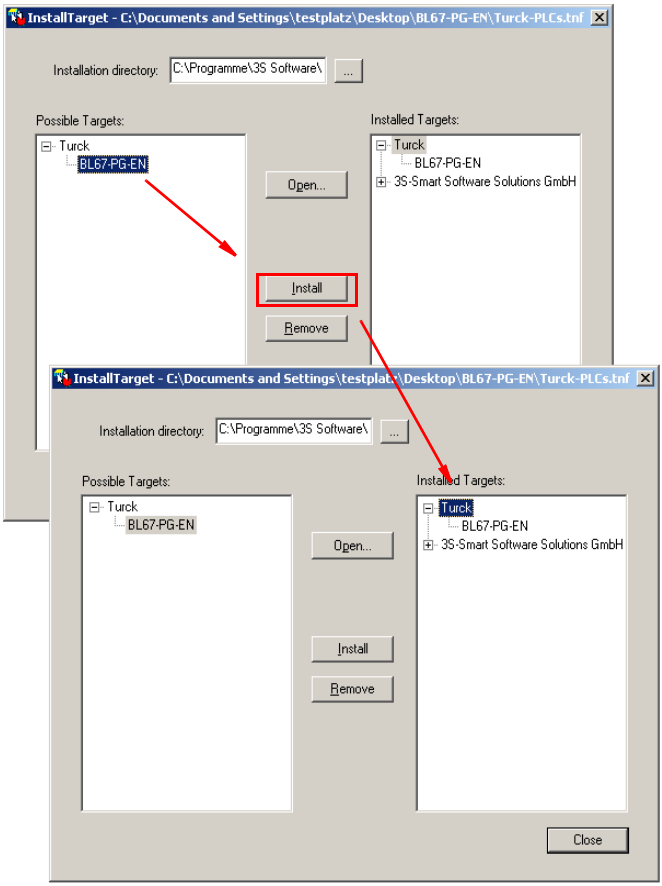
Figure 33: Select the target file



The BL67 target is installed using the "Install" button.

The BL67-PG-EN can now be found under "Installed Targets" and can be chosen in CoDeSys as a target now.

Figure 34: Installation of the TURCK target



BL67 Hardware Configuration

1. At first, configure your BL67 station (BL67-PG-EN and I/O modules) and switch on the power supply.
2. The gateway saves the actual station configuration, if the SET button under the cover on the gateway is pressed for approx. 10 seconds.
   The actual station configuration is now stored in the gateway as a reference module list.

Note

As soon as an application is loaded to the PG, the station configuration stored in the application is stored to the PG as reference module list.
IF no application is loaded to the PG, the SET button has to be pressed after every change in the station configuration.

3. The gateway now executes a reset.
4. If the "IO"-LED lights up green after the gateway's reset, the new station configuration has been successfully stored.

Configuration/ Programming of the PG in CoDeSys

Creating a new project

Start the Software an create a new project using the "File → New"-command.

Chose the BL67-PG-EN as target.

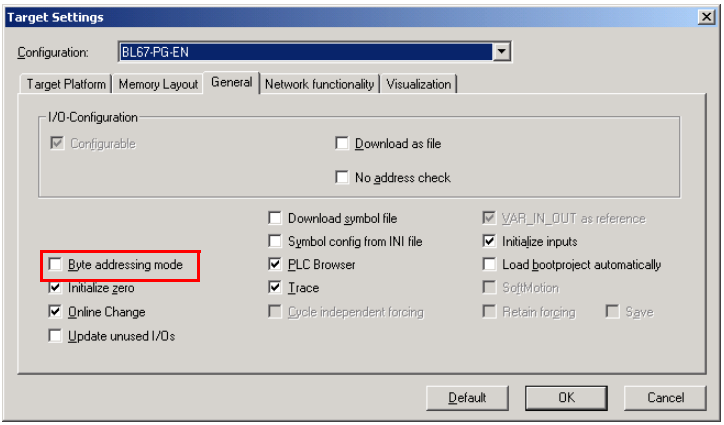
Normally, a further configuration of the gateway in the dialog box „target settings“ is not necessary.

Note

The BL67-PG-EN uses the word addressing mode (see the following table).
Please observe therefore, that the parameter "Byte addressing mode" in the "General" tab is always deactivated.

%IX**0**.0 - %IX**0**.7	%IX**0**.8 - %IX**0**.15	%IX**1**.0 - %IX**1**.7	%IX**1**.8 - %IX**1**.15	%IX**2**.0 - %IX**2**.7	%IX2.8 - %IX**2**.15	%IX**3**.0 - %IX**3**.7	%IX**3**.8 - %IX**3**.15	%IX**4**.0 - %IX**4**.7	%IX**4**.8 - %IX**4**.15	%IX**5**.0 - %IX**5**.7	%IX**5**.8 - %IX**5**.15
%IB0	%IB1	%IB2	%IB3	%IB4	%IB5	%IB6	%IB7	%IB8	%IB9	%IB10	%IB11
%IW**0**		%IW**1**		%IW**2**		%IW**3**		%IW**4**		%IW**5**	
%ID0				%ID1				%ID2			

Figure 35: Target settings



Pressing the "Ok" button created a new CoDeSys-project.

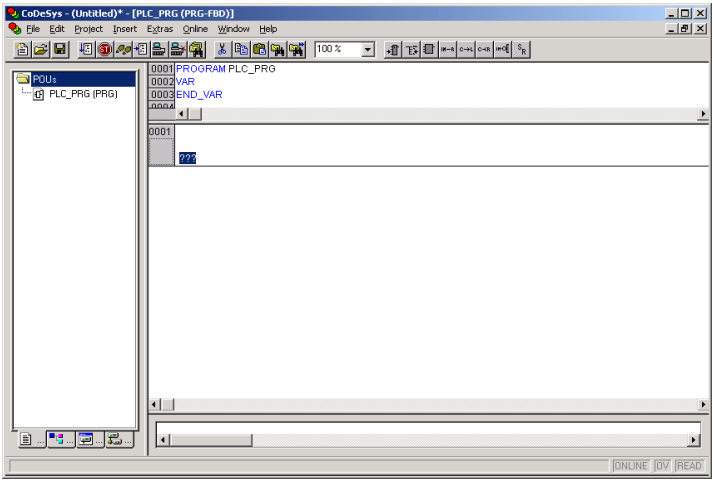
Attention

CoDeSys offers the possibility to control the processing of a project using the task management.

If no task configuration is defined, the project must contain a program named **PLC_PRG**.
The block PLC_PRG is automatically generated and is cyclically called by the runtime system.

PLC_PRG is always the main program in a Single-Task program.
If PLC_PRG is deleted or renamed, the project **must** be controlled using a task configuration.

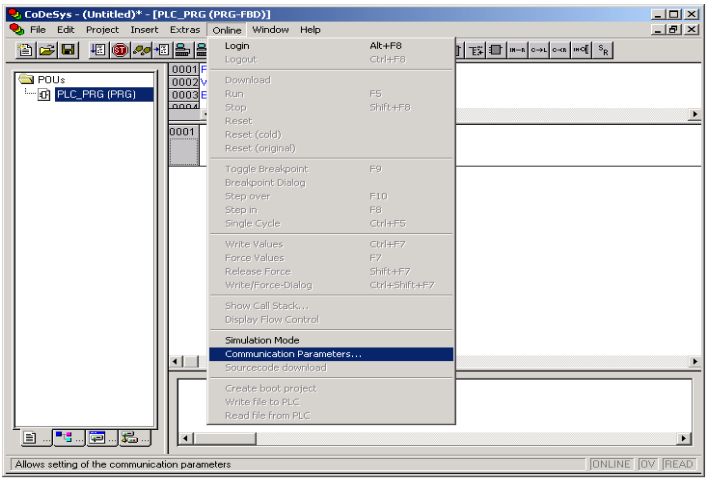
Figure 36: New CoDeSys-project



Now, the communication parameters for the target have to be adapted.

Communication parameters of the target

Figure 37: Opening the communication parameters



Mark "'localhost' via TCP/IP" in the „Channels“ field and define a new channel by pressing the „New“ button.

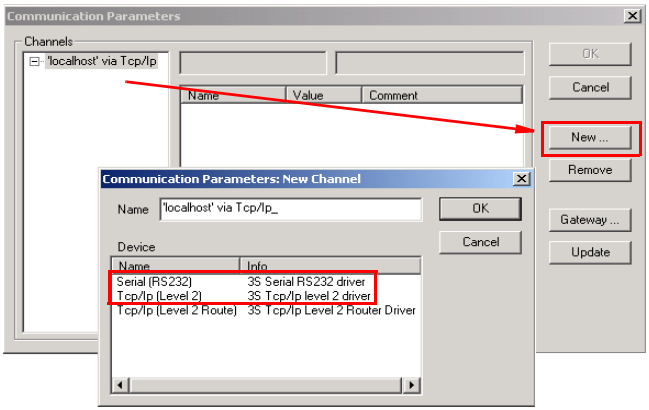
In the dialog box „Communication Parameters: New Channel“ the name for the new channel is edited and the communication interface is selected in the „Device“ field.

The BL67 gateway offers 2 possible communication interfaces:

1 PS/2 female connector for a serial RS232-communication

2 Ethernet connector (M12, 4-pole, D-coded) for a „TCP/IP (Level 2)"-communication.

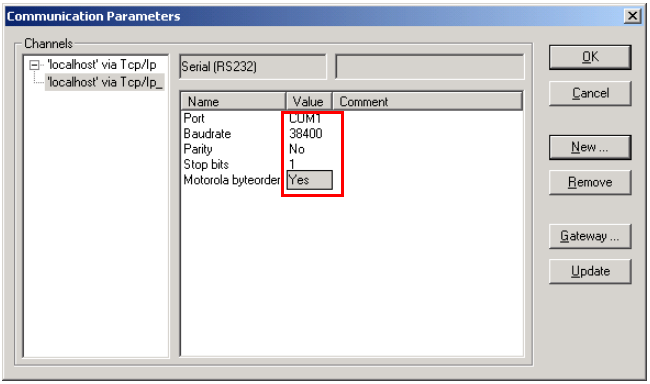
Figure 38: Defining a new channel



Select the preferred interface and set the parameters depending on the interface as follows:

1 serial RS232-communication:

Figure 39: Setting the communication parameters for RS232



Attention

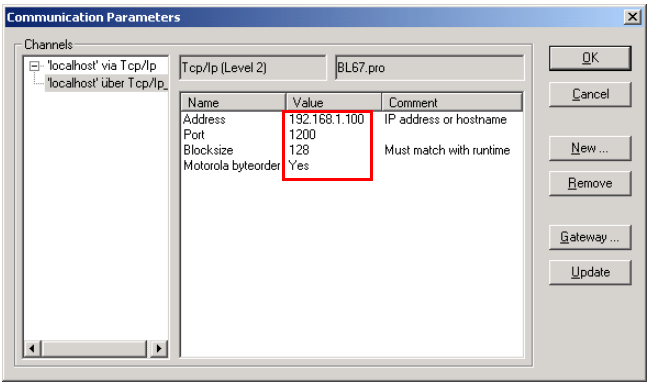
The Parameter "Motorola byteorder" must be set to "YES". Otherwise, no error-free communication with the gateway is possible.

Please observe that the communication with the PG is only possible with a baudrate of 115200 Baud, when using the serial RS32-interface.

2 TCP/IP (Level 2)-communication

Adapt the gateway's communication parameters (IP address, Motorola byteorder) as shown in the following figure.

Figure 40: Setting the communication parameters for TCP/IP (Level 2)



Attention

The Parameter "Motorola byteorder" must be set to "YES". Otherwise, no error-free communication with the gateway is possible.

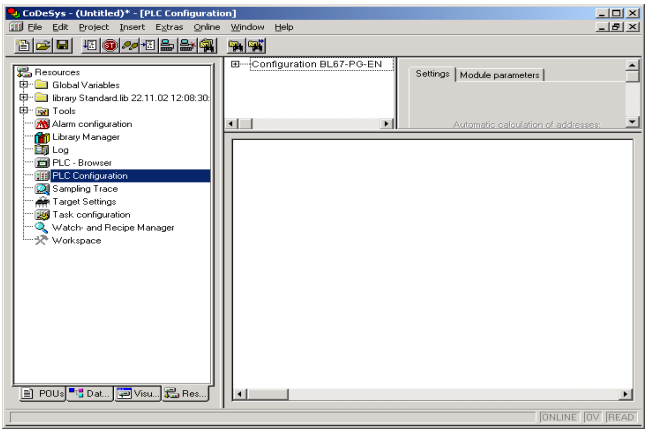
Note

When setting the IP address of the gateway, please observe that it has to match the settings of you PC network interface card. Otherwise, no communication can be built up between PC and PG (please read Chapter 8, "Network Configuration").

Configuration of the BL67 Station

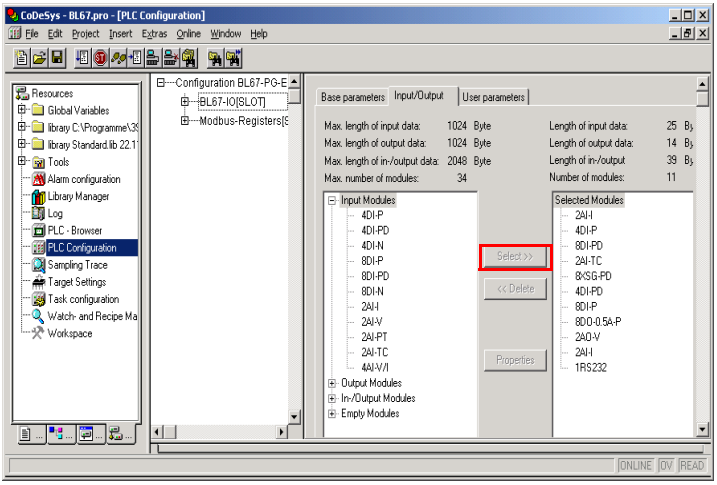
Open the „PLC Configuration“ in the „Resources“ tab.

Figure 41: PLC Configuration



Mark the BL67-IO[SLOT] and add the I/O modules to the gateway in the „Input/Output“ tab.

Figure 42: Selecting the I/O modules



Attention

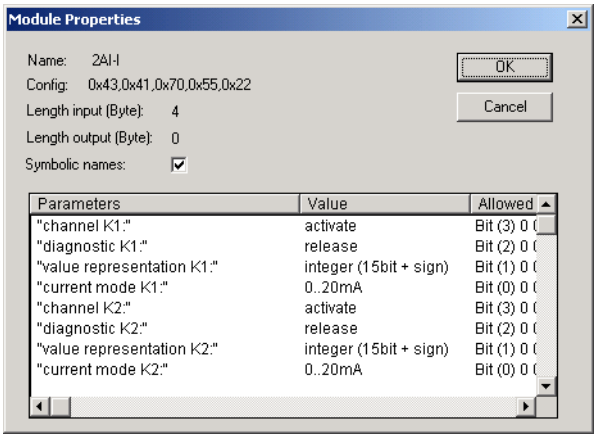
When configuring the BL67 station in the software, please observe that the order of the modules added to the gateway has to match the physical module order of the hardware configuration.

Parameterization of the I/O modules

For the parameterization of an I/O module mark the respective module in the „Selected Modules“ field and press the „Properties“ button.

In the „Module Properties“ dialog box each Parameter can be changed by double clicking the „Value“.

Figure 43: Parameterization of I/O modules


Module Properties
Name: 2AI-I
Config: 0x43,0x41,0x70,0x55,0x22
Length input (Byte): 4
Length output (Byte): 0
Symbolic names:
OK
Cancel
Parameters
Value
Allowed
"channel K1:" activate Bit (3) 0
"diagnostic K1:" release Bit (2) 0
"value representation K1:" integer (15bit + sign) Bit (1) 0
"current mode K1:" 0..20mA Bit (0) 0
"channel K2:" activate Bit (3) 0
"diagnostic K2:" release Bit (2) 0
"value representation K2:" integer (15bit + sign) Bit (1) 0
"current mode K2:" 0..20mA Bit (0) 0

Addressing the in- and output data

In- and output addresses as well as diagnostic addresses are automatically assigned to the gateway and the connected modules.

In addition to that, the gateway automatically receives a module ID as a unique identifier of the node within the entire configuration and

a node number shows the gateway's position in the configuration structure.

Note

The assignment of the in- and output addresses is done automatically and cannot be changed by the user.
In case of configuration changes, this assignment is also adapted automatically which may cause byte adjustments.
It is therefore recommended to add symbolic addresses to the logical address assignment of in- and outputs and to use only these symbolic addresses in the PLC program. (see Figure 44: „Hardware configuration with symbolic address allocation").

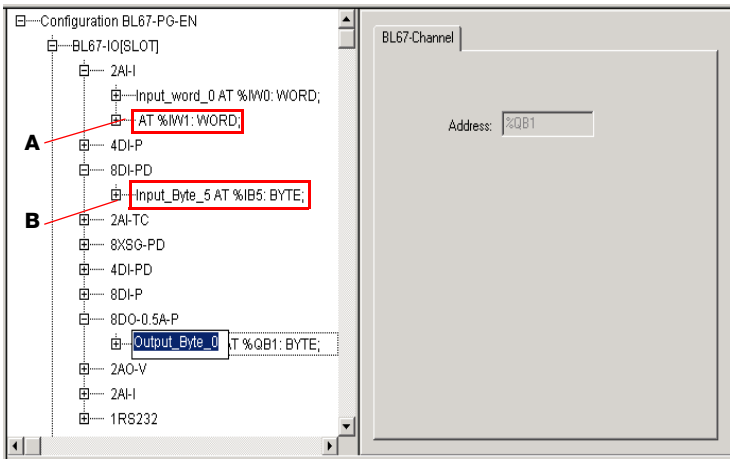
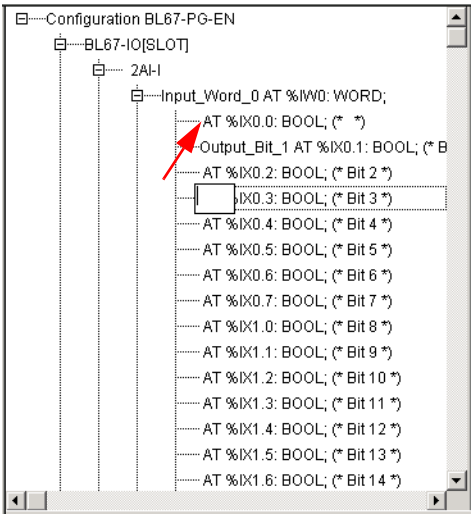


Figure 44: Hardware configuration with symbolic address allocation

A *logical address assignment (automatic)*
B *symbolic address assignment (application specific)*

A double click directly to the left of the entry of automatic addressing „AT%...“ opens the input field for the symbolic addressing.

Abbildung 45: Symbolic addressing


Configuration BL67-PG-EN
BL67-IO[SLOT]
2AI-I
Input_Word_0 AT %IW0: WORD;
AT %IX0.0: BOOL; (* *)
Output_Bit_1 AT %IX0.1: BOOL; (* B
AT %IX0.2: BOOL; (* Bit 2 *)
AT %IX0.3: BOOL; (* Bit 3 *)
AT %IX0.4: BOOL; (* Bit 4 *)
AT %IX0.5: BOOL; (* Bit 5 *)
AT %IX0.6: BOOL; (* Bit 6 *)
AT %IX0.7: BOOL; (* Bit 7 *)
AT %IX1.0: BOOL; (* Bit 8 *)
AT %IX1.1: BOOL; (* Bit 9 *)
AT %IX1.2: BOOL; (* Bit 10 *)
AT %IX1.3: BOOL; (* Bit 11 *)
AT %IX1.4: BOOL; (* Bit 12 *)
AT %IX1.5: BOOL; (* Bit 13 *)
AT %IX1.6: BOOL; (* Bit 14 *)

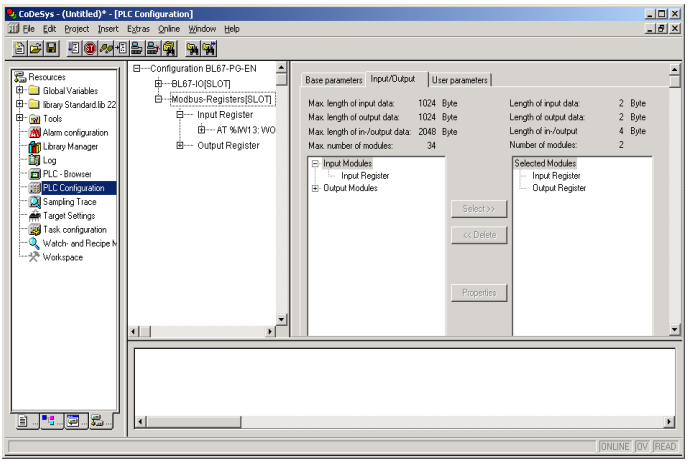
Mapping of the Modbus Registers

In order to enable Modbus communication of BL67-PG-EN with other Modbus nodes, the Modbus registers have to be added to the PLC configuration. (Modbus registers 0×4000 to 0×47FF, page 4-6).

Add the necessary in- and output registers to the PLC configuration under "Configuration BL67-PG-EN → Modbus-Registers [Slot]".

The in- and output addresses are automatically assigned to the Modbus registers.

Figure 46: Configuration of modbus registers



Therefore, a symbolic address allocation is also recommended for the in- and output words of the Modbus registers (see also Note on page 5-15).

Please observe, that Ethernet an the BL67 gateways are Big-Endian-systems (Motorola format).

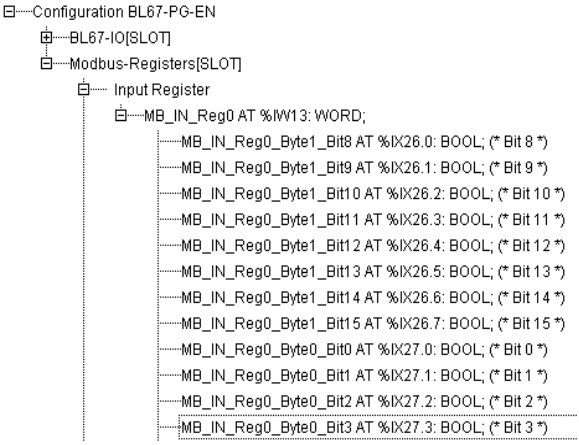
As shown in the following figure, the high byte of the register is listed first (%IX26 → bit 8 to bit 15), the low byte follows the high byte (%IX27 → bit 0 to bit 7).

The comments (*Bit 0*, *Bit 1* etc.) in the example have been changed according to the application.

Attention

Up to the time of the release of this manual, the automatic allocation of the comments by the software was faulty and did not show the correct bit order.

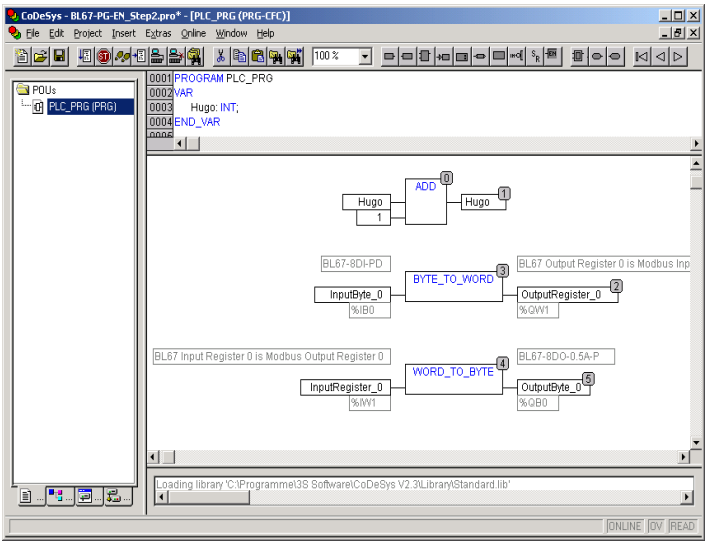
Figure 47: Symbolic address allocation for Modbus registers


Configuration BL67-PG-EN
BL67-IO[SLOT]
Modbus-Registers[SLOT]
Input Register
MB_IN_Reg0 AT %IW13: WORD;
MB_IN_Reg0_Byte1_Bit8 AT %IX26.0: BOOL; (* Bit 8 *)
MB_IN_Reg0_Byte1_Bit9 AT %IX26.1: BOOL; (* Bit 9 *)
MB_IN_Reg0_Byte1_Bit10 AT %IX26.2: BOOL; (* Bit 10 *)
MB_IN_Reg0_Byte1_Bit11 AT %IX26.3: BOOL; (* Bit 11 *)
MB_IN_Reg0_Byte1_Bit12 AT %IX26.4: BOOL; (* Bit 12 *)
MB_IN_Reg0_Byte1_Bit13 AT %IX26.5: BOOL; (* Bit 13 *)
MB_IN_Reg0_Byte1_Bit14 AT %IX26.6: BOOL; (* Bit 14 *)
MB_IN_Reg0_Byte1_Bit15 AT %IX26.7: BOOL; (* Bit 15 *)
MB_IN_Reg0_Byte0_Bit0 AT %IX27.0: BOOL; (* Bit 0 *)
MB_IN_Reg0_Byte0_Bit1 AT %IX27.1: BOOL; (* Bit 1 *)
MB_IN_Reg0_Byte0_Bit2 AT %IX27.2: BOOL; (* Bit 2 *)
MB_IN_Reg0_Byte0_Bit3 AT %IX27.3: BOOL; (* Bit 3 *)

PLC-Programming

Programming is done in the "POUs" tab.

Figure 48: Programming in r "POUs" tab



After the completion of the program, it is compiled using the „Project → Rebuild all..." command.

Online

The connection to the gateway is established with "Online → Login".

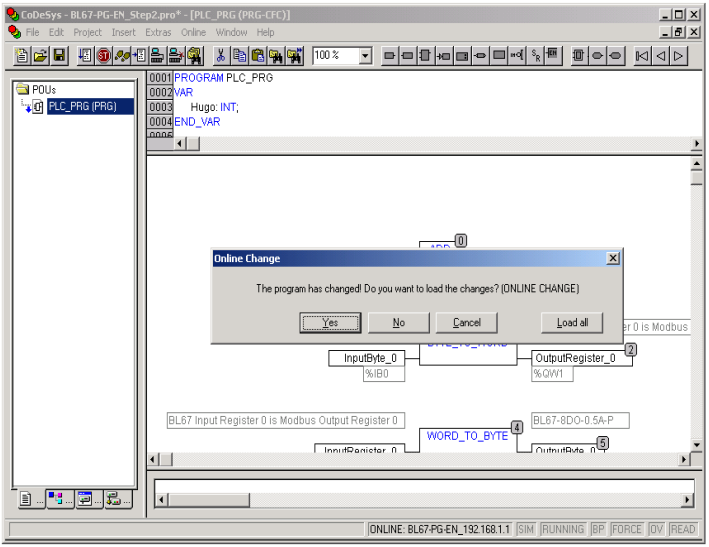
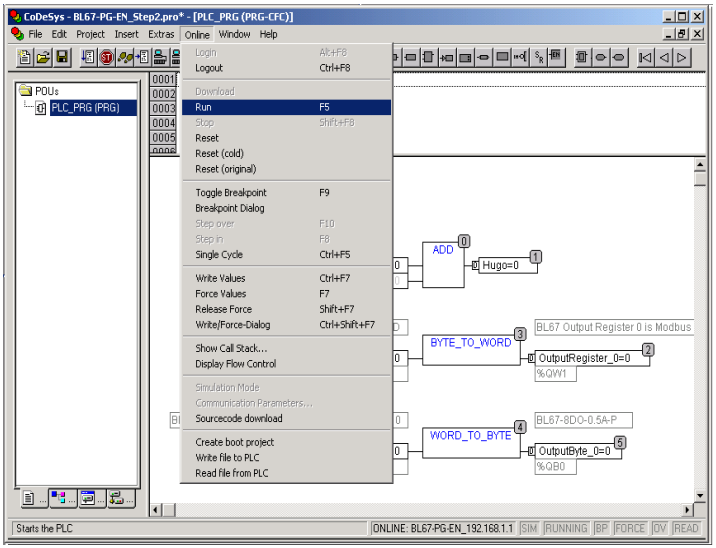


Figure 49: Download of the program

Download the program to the gateway and start it with "Online → Run".

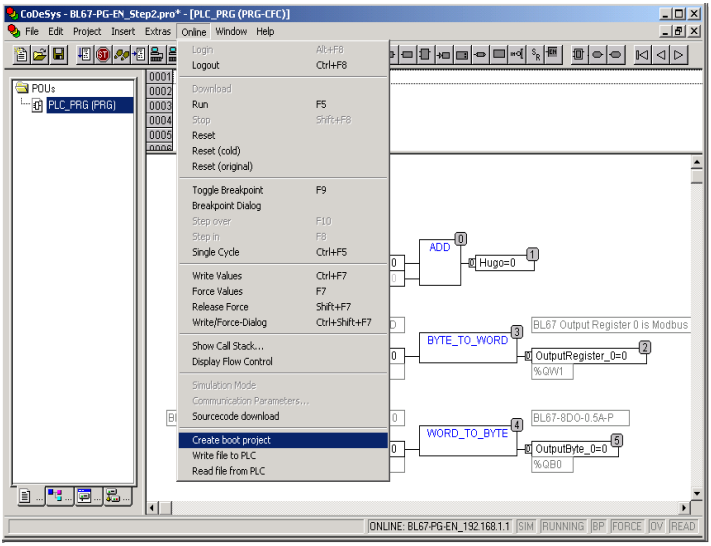
Figure 50: Starting the program



Creating a boot project

With "Online → create boot project" your program is saved as a boot project which is stored to the BL67-PG-EN and is automatically loaded at every re-start of the gateway.

Figure 51: Create boot project



6 Guidelines for Station Planning

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Module Arrangement

Random Module Arrangement

The arrangement of the I/O-modules within a BL67 station can basically be chosen at will.

Attention

Please observe, that RFID modules used within a station always have to be mounted directly following the gateway (slot 1 to 34).

Nevertheless, it can be useful with some applications to group certain modules together.

Complete Planning

The planning of a BL67 station should be thorough to avoid faults and increase operating reliability.

Attention

If there are more than two empty slots next to one another, the communication is interrupted to all following BL67 modules.

Maximum System Extension

A BL67 station can consist of a gateway and a maximum of 32 modules (equivalent to 1 m station length).

The following overview shows the maximum number of channels possible under these conditions:

- The entire station is made up of the respective channel type only.

Table 52: Maximum system extension

Module type	maximum number	
	Channels	Modules
BL67-4DI-P	128	32
BL67-8DI-P	256	32
BL67-4DO-xA-P	128	32
BL67-8DO-xA-P	256	32
BL67-16DO-0.1A-P	512	32
BL67-4DI4DO-PD	256	32
BL67-8XSG-PD	256	32
BL67-2AI-x	64	32
BL67-2AI-PT	64	32
BL67-2AI-TC	64	32
BL67-4AI-V/I	128	32
BL67-2AO-I	64	32
BL67-2AO-V	50 **A**	25 **A**
BL67-1RS232	10 **A**	10 **A**
BL67-1RS485/422	21 **A**	21 **A**
BL67-1SSI	26 **A**	26 **A**
BL67-1CVI	32	32

A *limited due to the high current consumption (max. 1,5 A) on the module bus (5 V)*

Module type	maximum number	
	Channels	Modules
BL67-2RFID-A	8	4
BL67-2RFID-C	8	4

Attention

Ensure that a sufficient number of Power Feeding modules are used if the system is extended to its maximum.

Note

If the system limits are exceeded, the software I/O-ASSISTANT generates an error message when the user activates the command ‹Station → Verify›.

Creating Potential Groups

Power Feeding modules can be used to create potential groups. The potential isolation of potential groups to the left of the respective power distribution modules is provided by the base modules.

Plugging and Pulling Electronic Modules

BL67 enables the pulling and plugging of electronic modules without having to disconnect the field wiring. The BL67 station remains in operation if an electronic module is pulled.
The voltage and current supplies as well as the protective earth connections are not interrupted.

Attention

If the field and system supplies remain connected when electronic modules are plugged or pulled, short interruptions to the module bus communications can occur in the BL67 station. This can lead to undefined statuses of individual inputs and outputs of different modules.

Extending an Existing Station

Attention

Please note that extensions to the station (mounting further modules) should be carried out only when the station is in a voltage-free state.

7 Guidelines for Electrical Installation

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Cable Routing Inside and Outside of Cabinets: 2
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General Notes

General

Cables should be grouped together, for example: signal cables, data cables, heavy current cables, power supply cables.

Heavy current cables and signal or data cables should always be routed in separate cable ducts or bundles. Signal and data cables must always be routed as close as possible to ground potential surfaces (for example support bars, cabinet sides etc.).

Cable Routing

Correct cable routing prevents or suppresses the reciprocal influencing of parallel routed cables.

Cable Routing Inside and Outside of Cabinets:

To ensure EMC-compatible cable routing, the cables should be grouped as follows:

Various types of cables within the groups can be routed together in bundles or in cable ducts.

Group 1:

- shielded bus and data cables
- shielded analog cables
- unshielded cables for DC voltage ≤ 60 V
- unshielded cables for AC voltage ≤ 25 V

Group 2:

- unshielded cables for DC voltage > 60 V and ≤ 400 V
- unshielded cables for AC voltage > 25 V and ≤ 400 V

Group 3:

- unshielded cables for DC and AC voltages > 400 V

The following group combination can be routed only in separate bundles or separate cable ducts (no minimum distance apart):

- **Group 1/Group 2**

The group combinations:

- **Group 1/Group 3 and Group 2/Group 3**

must be routed in separate cable ducts with a minimum distance of 10 cm apart. This is equally valid for inside buildings as well as for inside and outside of switchgear cabinets.

Cable Routing Outside Buildings

Outside of buildings, cables should be routed in closed (where possible), cage-type cable ducts made of metal. The cable duct joints must be electrically connected and the cable ducts must be earthed.

Warning

Observe all valid guidelines concerning internal and external lightning protection and grounding specifications when routing cables outside of buildings.

Lightning Protection

The cables must be routed in double-grounded metal piping or in reinforced concrete cable ducts.

Signal cables must be protected against overvoltage by varistors or inert-gas filled overvoltage arrestors. Varistors and overvoltage arrestors must be installed at the point where the cables enter the building.

Transmission Media

For a communication via Ethernet, different transmission media can be used:

- coaxial cable
  10Base2 (thin koax),
  10Base5 (thick koax, yellow cable)
- optical fibre (10BaseF)
- twisted two-wire cable (10BaseT) with shielding (STP) or without shielding (UTP).

Note

TURCK offers a variety of cable types for fieldbus lines as premoulded or bulk cables with different connectors.
The ordering information for the available cable types can be found in the BL67 catalog.

Potential Relationships

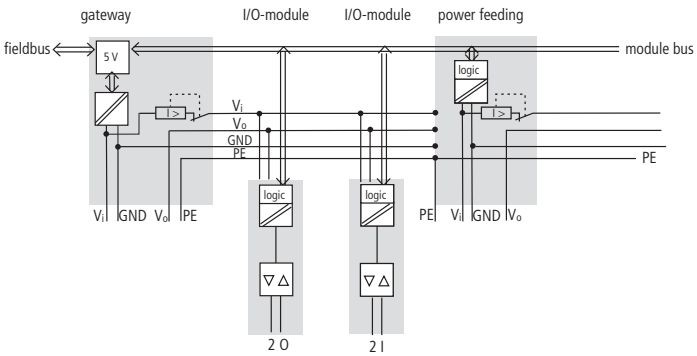
General

The potential relationship of a Ethernet system realized with BL67 modules is characterized by the following:

- The system supply of gateway and I/O-modules as well as the field supply are realized via one power feed at the gateway.
- All BL67 modules (gateway, Power Feeding and I/O-modules), are connected capacitively via base modules to the mounting rails.

The block diagram shows the arrangement of a typical BL67 station.

Figure 52: Block diagram of a BL67 station



Electromagnetic Compatibility (EMC)

BL67 products comply in full with the requirements pertaining to EMC regulations.

Nevertheless, an EMC plan should be made before installation. Hereby, all potential electromechanical sources of interference should be considered such as galvanic, inductive and capacitive couplings as well as radiation couplings.

Ensuring Electromagnetic Compatibility

The EMC of BL67 modules is guaranteed when the following basic rules are adhered to:

- Correct and large surface grounding of inactive metal components.
- Correct shielding of cables and devices.
- Proper cable routing – correct wiring.
- Creation of a standard reference potential and grounding of all electrically operated devices.
- Special EMC measures for special applications.

Grounding of Inactive Metal Components

All inactive metal components (for example: switchgear cabinets, switchgear cabinet doors, supporting bars, mounting plates, tophat rails, etc.) must be connected to one another over a large surface area and with a low impedance (grounding). This guarantees a standardized reference potential area for all control elements and reduces the influence of coupled disturbances.

- In the areas of screw connections, the painted, anodized or isolated metal components must be freed of the isolating layer. Protect the points of contact against rust.
- Connect all free moving groundable components (cabinet doors, separate mounting plates, etc.) by using short bonding straps to large surface areas.

- Avoid the use of aluminum components, as its quick oxidizing properties make it unsuitable for grounding.

Warning

The grounding must never – including cases of error – take on a dangerous touch potential. For this reason, always protect the ground potential with a protective cable.

PE Connection

A central connection must be established between ground and PE connection (protective earth).

Earth-Free Operation

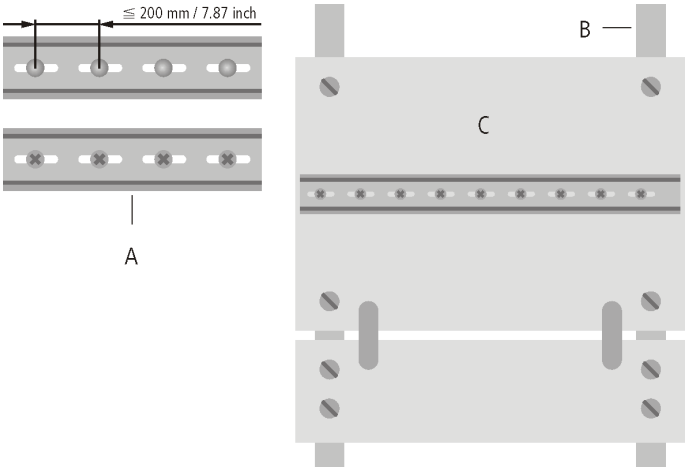
Observe all relevant safety regulations when operating an earthfree system.

Mounting Rails

All mounting rails must be mounted onto the mounting plate with a low impedance, over a large surface area, and must be correctly earthed.

Figure 53:
Mounting options

A *TS 35*
B *Mounting rail*
C *Mounting plate*



Mount the mounting rails over a large surface area and with a low impedance to the support system using screws or rivets.

Remove the isolating layer from all painted, anodized or isolated metal components at the connection point. Protect the connection point against corrosion (for example with grease; caution: use only suitable grease).

Shielding of cables

Shielding is used to prevent interference from voltages and the radiation of interference fields by cables. Therefore, use only shielded cables with shielding braids made from good conducting materials (copper or aluminum) with a minimum degree of coverage of 80 %.

The cable shield should always be connected to both sides of the respective reference potential (if no exception is made, for example, such as high-resistant, symmetrical, analog signal cables). Only then can the cable shield attain the best results possible against electrical and magnetic fields.

A one-sided shield connection merely achieves an isolation against electrical fields.

Attention

When installing, please pay attention to the following...

– the shield should be connected immediately when entering the
– system,
– the shield connection to the shield rail should be of low
– impedance,
– the stripped cable-ends are to be kept as short as possible,
– the cable shield is not to be used as a bonding conductor.

If the data cable is connected via a SUB-D connector, the shielding should never be connected via pin 1, but to the mass collar of the plug-in connector.

The insulation of the shielded data-cable should be stripped and connected to the shield rail when the system is not in operation. The connection and securing of the shield should be made using metal shield clamps. The shield clamps must enclose the shielding braid and in so doing create a large surface contact area. The shield rail must have a low impedance (for example, fixing points of 10 to 20 cm apart) and be connected to a reference potential area.

The cable shield should not be severed, but routed further within the system (for example, to the switchgear cabinet), right up to the interface connection.

Note

Should it not be possible to ground the shield on both sides due to switching arrangements or device specific reasons, then it is possible to route the second cable shield side to the local reference potential via a capacitor (short connection distances). If necessary, a varistor or resistor can be connected parallel to the capacitor, to prevent disruptive discharges when interference pulses occur.

A further possibility is a double-shielded cable (galvanically separated), whereby the innermost shield is connected on one side and the outermost shield is connected on both sides.

Potential Compensation

Potential differences can occur between installation components that are in separate areas and these

- are fed by different supplies,
- have double-sided conductor shields which are grounded on different installation components.

A potential-compensation cable must be routed to the potential compensation.

Warning

Never use the shield as a potential compensation.

A potential compensation cable must have the following characteristics:

- Low impedance. In the case of compensation cables that are routed on both sides, the compensation line impedance must be considerably smaller than that of the shield connection (max. 10 % of shield connection impedance).
- Should the length of the compensation cable be less than 200 m, then its cross-section must be at least 16 mm^2 / 0.025 $inch^2$. If the cable length is greater than 200 m, then a cross-section of at least 25 mm^2 / 0.039 $inch^2$ is required.
- The compensation cable must be made of copper or zinc coated steel.
- The compensation cable must be connected to the protective conductor over a large surface area and must be protected against corrosion.
- Compensation cables and data cables should be routed as close together as possible, meaning the enclosed area should be kept as small as possible.

Switching Inductive Loads

In the case of inductive loads, a protective circuit on the load is recommended.

Protection against Electrostatic Discharge (ESD)

Attention

Electronic modules and base modules are at risk from electrostatic discharge when disassembled. Avoid touching the bus connections with bare fingers as this can lead to ESD damage.

8 Appendix

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Network Configuration

Note

In order to build up the communication between the BL67-gateway and a PLC/ PC or a network interface card, both devices have to be hosts in the same network.

The network is already defined by the default-settings in the BL67-gateways.

The default IP address for the BL67-gateways is 192.168.1.254 (see also Chapter 2, page 2-2, section „IP address").

If necessary, please adjust the IP address of the PLC/ PC or the network interface card.

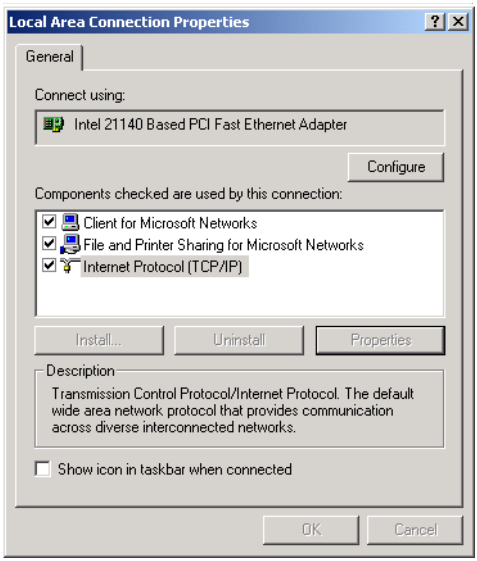
Changing the IP address of a PC/ network interface card

Changing the IP address in Windows 2000/ Windows XP

The IP address is changed in the "Control Panel" in "Network and Dial-up Connections":

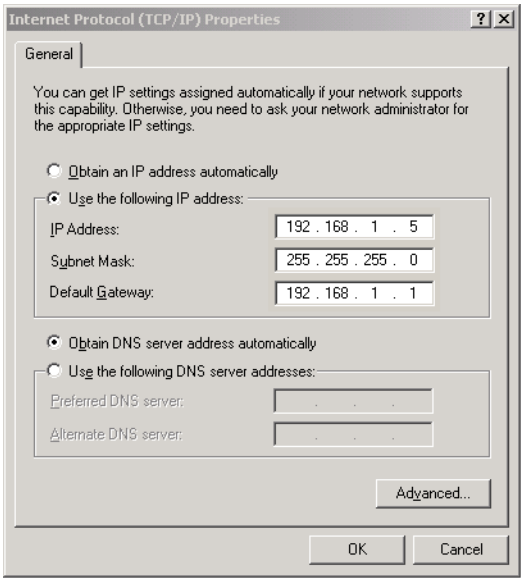
1. Open the folder "Local Area Connection" and open the dialog "Local Area Connection Properties" via the button "Properties" in the dialog "Local Area Connection Status".
2. Mark "Internet Protocol (TCP/IP)" and press the "Properties"-button to open the dialog "Internet Protocol (TCP/IP) Properties".

Figure 54: Local Area Connection Properties



3 Activate "Use the following IP address" and assign an IP address of the network mentioned above to the PC/ Network interface card (see the following figure).

Figure 55: Changing the PC's IP address

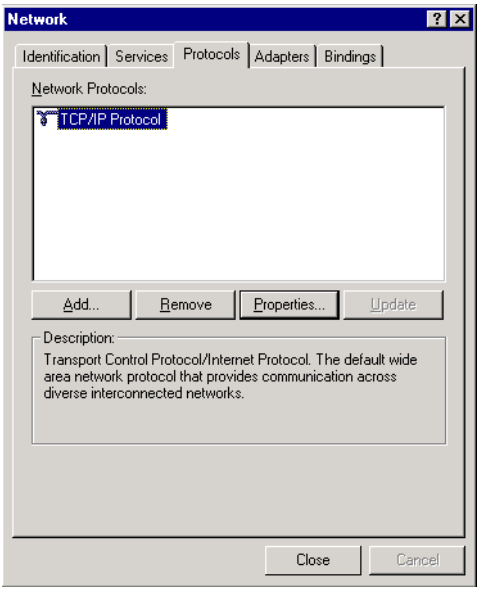

Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP Address:
192 . 168 . 1 . 5
Subnet Mask:
255 . 255 . 255 . 0
Default Gateway:
192 . 168 . 1 . 1
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

Changing the IP address in Windows NT

1 Open the folder "Network" in the Control Panel.

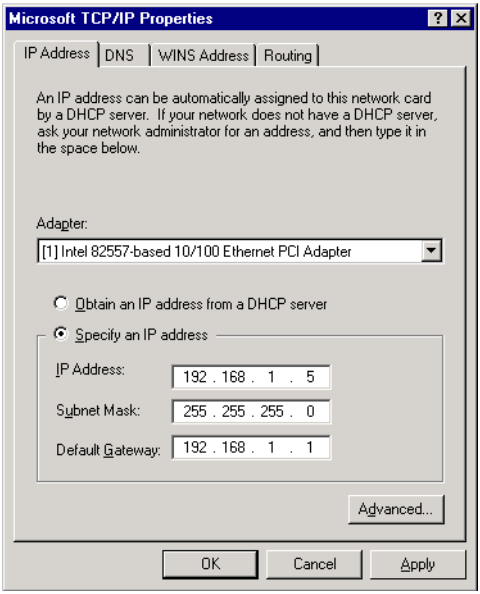
2 Activate TCP/IP connection in the tab "Protocols" and click the "Properties" button.

Figure 56: Network configuration WIN NT



3 Activate "Specify IP address " and set the address as follows.

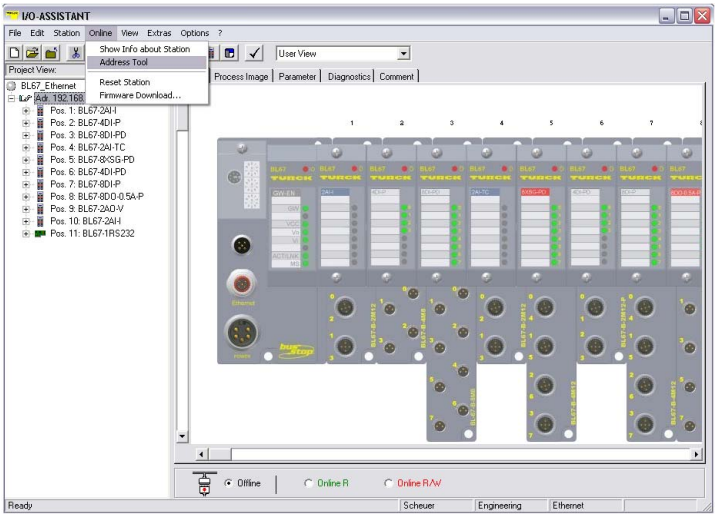
Figure 57:
Specify IP address


Microsoft TCP/IP Properties
IP Address
DNS
WINS Address
Routing
An IP address can be automatically assigned to this network card by a DHCP server. If your network does not have a DHCP server, ask your network administrator for an address, and then type it in the space below.
Adapter:
[1] Intel 82557-based 10/100 Ethernet PCI Adapter
Obtain an IP address from a DHCP server
Specify an IP address
IP Address:
192 . 168 . 1 . 5
Subnet Mask:
255 . 255 . 255 . 0
Default Gateway:
192 . 168 . 1 . 1
Advanced...
OK
Cancel
Apply

Changing the IP address via I/O-ASSISTANT

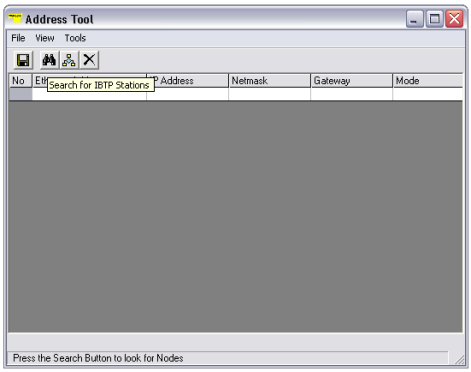
The Address Tool integrated in the I/O-ASSISTANT offers the possibility to browse the whole Ethernet network for connected nodes and to change their IP address as well as the subnet mask according to the application.

Figure 58: Address Tool in the I/O-ASSISTANT



The network is browsed by using the search function in the Address Tool.

Figure 59: Search function in the Address Tool



Attention

If Windows XP is used as operating system, problems with the system internal firewall may occur.

It may eventually inhibit the access of the I/O-ASSISTANT to the Ethernet. Please adapt your firewall settings accordingly or deactivate it completely (see also „Deactivating/ adapting the firewall in Windows XP", page 8-9).

The network is browsed for connected hosts which are then listed in the Address Tool.

The address changing is done via "Tools → Changing IP settings...".

It is now possible to change the address settings for all nodes in the list or only for the selected one.

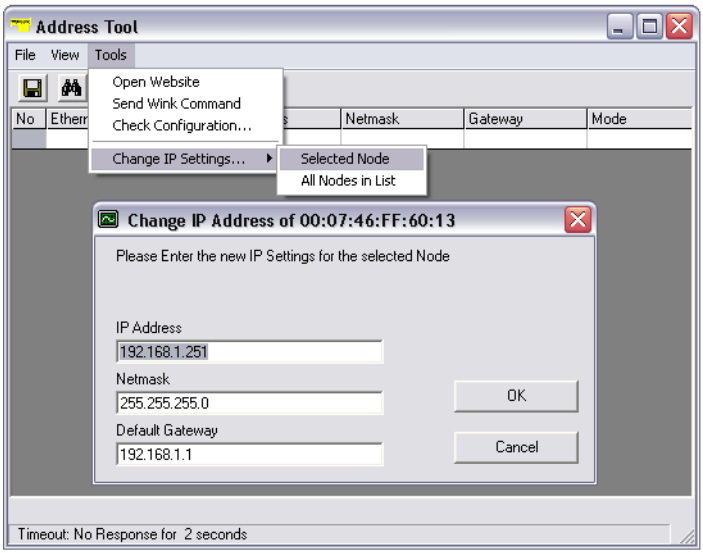


Figure 60: Address changing for selected nodes

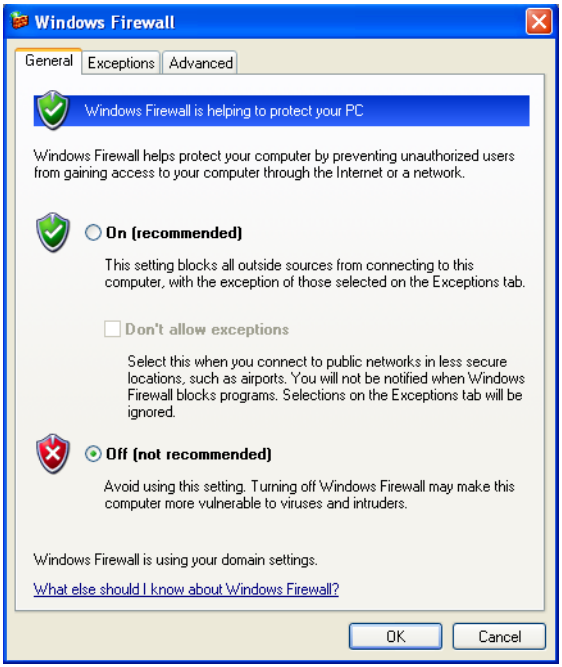
Deactivating/ adapting the firewall in Windows XP

If Windows XP is used as operating system, problems with the system-integrated firewall may occur in case of an access of outside sources to your computer or in case of tools like the I/O-ASSISTANT which are used for changing the IP address of the gateways.

In this case, you can deactivate the system integrated Windows XP firewall completely or adapt it to your application.

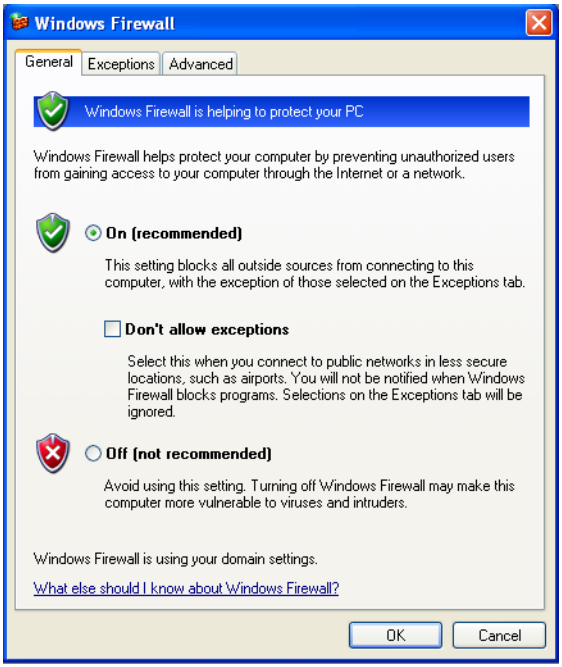
- **Deactivating the firewall**
  Open the "Windows Firewall" dialog in the control panel of your PC and deactivate it as follows:

Figure 61: Deactivating the Windows firewall


Windows Firewall
General
Exceptions
Advanced
Windows Firewall is helping to protect your PC
Windows Firewall helps protect your computer by preventing unauthorized users from gaining access to your computer through the Internet or a network.
On (recommended)
This setting blocks all outside sources from connecting to this computer, with the exception of those selected on the Exceptions tab.
Don't allow exceptions
Select this when you connect to public networks in less secure locations, such as airports. You will not be notified when Windows Firewall blocks programs. Selections on the Exceptions tab will be ignored.
Off (not recommended)
Avoid using this setting. Turning off Windows Firewall may make this computer more vulnerable to viruses and intruders.
Windows Firewall is using your domain settings.
What else should I know about Windows Firewall?
OK
Cancel

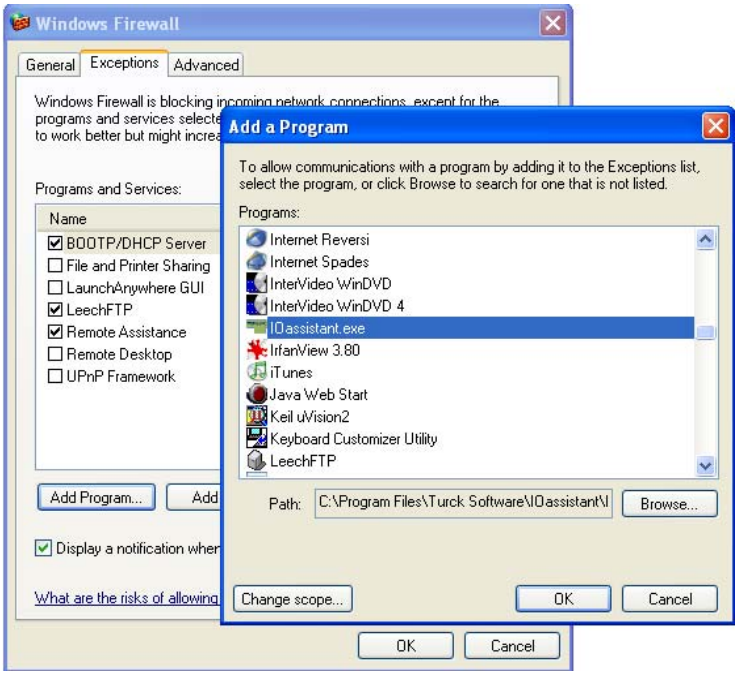
- **Adapting the firewall**
  The firewall remains active, the option "Don't allow exceptions" it deactivated:

Figure 62: Activating the Windows firewall


Windows Firewall
General
Exceptions
Advanced
Windows Firewall is helping to protect your PC
Windows Firewall helps protect your computer by preventing unauthorized users from gaining access to your computer through the Internet or a network.
On (recommended)
This setting blocks all outside sources from connecting to this computer, with the exception of those selected on the Exceptions tab.
Don't allow exceptions
Select this when you connect to public networks in less secure locations, such as airports. You will not be notified when Windows Firewall blocks programs. Selections on the Exceptions tab will be ignored.
Off (not recommended)
Avoid using this setting. Turning off Windows Firewall may make this computer more vulnerable to viruses and intruders.
Windows Firewall is using your domain settings.
What else should I know about Windows Firewall?
OK
Cancel

- In the "Exceptions"-tab, add the programs or services for which you want to allow the access to your computer.

Figure 63: "Exceptions"-tab



Note

Despite an active firewall, the I/O-ASSISTANT for example is now able to browse the network for hosts and the address changing via the software is possible for the connected nodes.

Nominal Current Consumption of Modules at Ethernet

Table 53: nominal current consumptions of the modules at Ethernet

Module	Current consumptions on 24 V DC
BL67-GW-EN	
Power supply modules	
BL67-PF-24VDC	≤ 9 mA
Digital input modules	
BL67-4DI-P	≤ 9 mA
BL67-8DI-P	≤ 9 mA
BL67-4DI-PD	≤ 35 mA
BL67-8DI-PD	≤ 35 mA
BL67-4DI-N	≤ 8 mA
BL67-8DI-N	≤ 8 mA
Analog input modules	
BL67-2AI-I	≤ 10 mA
BL67-2AI-V	≤ 10 mA
BL67-2AI-PT	≤ 13 mA
BL67-2AI-TC	≤ 10 mA
Digital output modules	
BL67-4DO-0.5A-P	≤ 9 mA
BL67-4DO-2A-P	≤ 9 mA
BL67-8DO-0.5A-P	≤ 9 mA
BL67-4DO-2A-N	≤ 24 mA
BL67-8DO-0.5A-N	≤ 24 mA
BL67-16DO-0.1A-P	≤ 9 mA

Analog output modules	
BL67-2AO-I	≤ 12 mA
BL67-2AO-V	≤ 17 mA
Digital combi modules	
BL67-4DI/4DO-PD	≤ 35 mA
BL867-8XSG-PD	≤ 35 mA
Technology modules	
BL67-1RS232	≤ 28 mA
BL67-1RS485/422	≤ 20 mA
BL67-1SSI	≤ 32 mA
BL67-1CVI	≤ 24 mA

Note

Please find any information about the bus-independent, module specific current consumptions in the manual "BL67- I/O-modules" (TURCK-Documentation No.: German D300572/ English D300527).

9 Glossary

A

Acknowledge

Acknowledgment of a signal received.

Active metal component

Conductor or conducting component that is electrically live during operation.

Address

Identification number of, e.g. a memory position, a system or a module within a network.

Addressing

Allocation or setting of an address, e. g. for a module in a network.

ARP

Used to definitely allocate the hardware addresses (MAC-IDs) assigned world-wide to the IP addresses of the network clients via internal tables.

Analog

Infinitely variable value, e. g. voltage. The value of an analog signal can take on any value, within certain limits.

Automation device

A device connected to a technical process with inputs and outputs for control. Programmable logic controllers (PLC) are a special group of automation devices.

B

Baud

Baud is a measure for the transmission speed of data. 1 Baud corresponds to the transmission of one bit per second (bit/s).

Baud rate

Unit of measurement for measuring data transmission speeds in bit/s.

Bidirectional

Working in both directions.

Bonding strap

Flexible conductor, normally braided, that joins inactive components, e. g. the door of a switchgear cabinet to the cabinet main body.

Bus

Bus system for data exchange, e. g. between CPU, memory and I/O levels. A bus can consist of several parallel cables for data transmission, addressing, control and power supply.

Bus cycle time

Time required for a master to serve all slaves or stations in a bus system, i. e. reading inputs and writing outputs.

Bus line

Smallest unit connected to a bus, consisting of a PLC, a coupling element for modules on the bus and a module.

Bus system

All units which communicate with one another via a bus.

C

Capacitive coupling

Electrical capacitive couplings occur between cables with different potentials. Typical sources of interference are, for example, parallel-routed signal cables, contactors and electrostatic discharges.

Check-back interface

The check-back interface is the interface from the counter module to the internal module bus. The bits and bytes are converted by the gateway from the respective type of communication applicable to the fieldbus in to the module-specific bits and bytes.

Coding elements

Two-piece element for the unambiguous assignment of electronic and base modules.

Configuration

Systematic arrangement of the I/O-modules of a station.

Control interface

The control interface is the interface from the internal module bus to the counter module. The commands and signals directed to the counter module are converted by the gateway from the respective type of communication applicable to the fieldbus in to the module-specific bits and bytes.

CPU

Central Processing Unit. Central unit for electronic data processing, the processing core of the PC.

D

DHCP

Client-Server-protocol which reduces the effort of assigning IP addresses or other parameters. Serves for dynamic and automatic configuration of devices.

Digital

A value (e. g. a voltage) which can adopt only certain statuses within a finite set, mostly defined as 0 and 1.

DIN

German acronym for German Industrial Standard.

E

EIA

Electronic Industries Association – association of electrical companies in the United States.

Electrical components

All objects that produce, convert, transmit, distribute or utilize electrical power (e. g. conductors, cable, machines, control devices).

EMC

Electromagnetic compatibility – the ability of an electrical part to operate in a specific environment without fault and without exerting a negative influence on its environment.

EN

German acronym for European Standard.

ESD

Electrostatic Discharge.

F

Field power supply

Voltage supply for devices in the field as well as the signal voltage.

Fieldbus

Data network on sensor/actuator level. A fieldbus connects the equipment on the field level. Characteristics of a fieldbus are a high transmission security and real-time behavior.

Force Mode

Software mode which enables the user to set his plant to a required state by forcing certain variables on the input and output modules.

G

GND

Abbreviation of ground (potential "0").

Ground

Expression used in electrical engineering to describe an area whose electrical potential is equal to zero at any given point. In neutral grounding devices, the potential is not necessarily zero, and one speaks of the ground reference.

Ground connection

One or more components that have a good and direct contact to earth.

Ground reference

Potential of ground in a neutral grounding device. Unlike earth whose potential is always zero, it may have a potential other than zero.

H

Hexadecimal

System of representing numbers in base 16 with the digits 0... 9, and further with the letters A, B, C, D, E and F.

Hysteresis

A sensor can get caught up at a certain point, and then "waver" at this position. This condition results in the counter content fluctuating around a given value. Should a reference value be within this fluctuating range, then the relevant output would be turned on and off in rhythm with the fluctuating signal.

I

I/O

Input/output.

Impedance

Total effective resistance that a component or circuit has for an alternating current at a specific frequency.

Inactive metal components

Conductive components that cannot be touched and are electrically isolated from active metal components by insulation, but can adopt voltage in the event of a fault.

9

Inductive coupling

Magnetic inductive couplings occur between two cables through which an electrical current is flowing. The magnetic effect caused by the electrical currents induces an interference voltage. Typical sources of interference are for example, transformers, motors, parallel-routed network and HF signal cables.

Intelligent modules

Intelligent modules are modules with an internal memory, able to transmit certain commands (e. g. substitute values and others).

IP

Abbreviation for Internet-Protocol, protocol for the packet-oriented and connectionless transport of data packets from a transmitter to a receiver crossing different networks.

L

Lightning protection

All measures taken to protect a system from damage due to overvoltages caused by lightning strike.

Low impedance connection

Connection with a low AC impedance.

LSB

Least Significant bit

M

Mass

All interconnected inactive components that do not take on a dangerous touch potential in the case of a fault.

Master

Station in a bus system that controls the communication between the other stations.

MODBUS-TCP

The Modbus protocol is part of the TCP/IP protocol.

The communication is realized via function codes, which are implemented into the data telegram. MODBUS-TCP uses the Transport Control Protocol (TCP) for the transmission of the Modbus user protocol in Ethernet-TCP-IP networks.

Module bus

The module bus is the internal bus in a station. The modules communicate with the gateway via the module bus which is independent of the fieldbus.

MSB

Most Significant bit

P

Ping

Implementation of an echo-protocol, used for testing whether a particular host is operating properly and is reachable on the network from the testing host.

9

PLC

Programmable Logic Controller.

Potential compensation

The alignment of electrical levels of electrical components and external conductive components by means of an electrical connection.

Potential free

Galvanic isolation of the reference potentials in I/O-modules of the control and load circuits.

Potential linked

Electrical connection of the reference potentials in I/O-modules of the control and load circuits.

Protective earth

Electrical conductor for protection against dangerous shock currents. Generally represented by PE (protective earth).

R

Radiation coupling

A radiation coupling appears when an electromagnetic wave hits a conductive structure. Voltages and currents are induced by the collision. Typical sources of interference are for example, sparking gaps (spark plugs, commutators from electric motors) and transmitters (e. g. radio), that are operated near to conducting structures.

Reaction time

The time required in a bus system between a reading operation being sent and the receipt of an answer. It is the time required by an input module to change a signal at its input until the signal is sent to the bus system.

Reference potential

Potential from which all voltages of connected circuits are viewed and/or measured.

Repeater

Amplifier for signals transmitted via a bus.

Root-connecting

Creating a new potential group using a power distribution module. This allows sensors and loads to be supplied individually.

RS 485

Serial interface in accordance with EIA standards, for fast data transmission via multiple transmitters.

S

Serial

Type of information transmission, by which data is transmitted bit by bit via a cable.

Setting parameters

Setting parameters of individual stations on the bus and their modules in the configuration software of the master.

Shield

Conductive screen of cables, enclosures and cabinets.

Shielding

Description of all measures and devices used to join installation components to the shield.

Short-circuit proof

Characteristic of electrical components. A short-circuit proof part withstands thermal and dynamic loads which can occur at its place of installation due to a short circuit.

Station

A functional unit or I/O components consisting of a number of elements.

T

TCP

Abbreviation for Transmission Control Protocol, connection-oriented transport protocol within the Internet protocol suite. Certain error detection mechanisms (i.e. acknowledgements, time-out monitoring) can guarantee a safe and error free data transport.

Terminating resistance

Resistor on both ends of a bus cable used to prevent interfering signal reflections and which provides bus cable matching. Terminating resistors must always be the last component at the end of a bus segment.

To ground

Connection of a conductive component with the grounding connection via a grounding installation.

Topology

Geometrical structure of a network or the circuitry arrangement.

U

UDP

Abbreviation for User Datagram Protocol. UDP is an transport protocol for the connectionless data between Ethernet hosts.

Unidirectional

Working in one direction.

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